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From Near Berkeley

BY

FREDERICK CHAPMAN

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SOME PLIOCENE OSTRACODA
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NEAR BERKELEY, CALIFORNIA,

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GEOLOGICAL RELATIONS.

IN the latter part of last year Prof. T. Rupert Jones kindly handed to me for description several specimens of rocks of Pliocene age containing numerous Ostracoda. These rock specimens had been sent to Prof. Rupert Jones by Dr. J. C. Merriam, of the University of California, who wished a detailed examination of them to be made, since the Ostracoda appeared to be of exceptional interest. In one of the letters accompanying the specimens Dr. Merriam says: "The Ostracoda occur at several horizons in the Pliocene near Berkeley, California. Some of the fossiliferous beds are important geological features of the country, and extend for several miles through a region in which few other invertebrate fossils are known."

BRUCE L. CLARK

For this reason Dr. Merriam thinks the Ostracoda may be of considerable use in determining horizons.

The following note on the Ostracod-bearing rocks has since been kindly furnished by Dr. Merriam. I quote it here in full:—

"The Ostracods occur in a very thick series of conglomerates, clays, limestones, and eruptives, which is well developed in the hills east of Berkeley, California, and belongs, according to Prof. A. C. Lawson, to the lower division of the Pliocene.* They are found at various horizons in clays and limestones, from the lower to near the upper portion of the series.

"Most of the localities at which the Ostracoda were abundant (Nos. 585, 589, 26, 297), seem to be near the middle portion of the series. Here they are enormously abundant, often forming layers of impure limestone a foot or more in thickness. The limestone strata, of which there are usually several, alternate with beds of either clayey or tufaceous material ten or more feet thick. The conditions favoring growth and multiplication of the Ostracoda seem to have been particularly favorable in this region during the period in which these limestone beds were laid down. Lower down in the series, at locality No. 587, Ostracoda are quite abundant in a soft blue shale. Near the top of the section they are frequently present, but not in such numbers as to form a marked feature of the rocks."

LOCALITIES.

The five rock samples received are localized as follows: "No. 585.† Wild Cat Cañon, opposite the Caves." From this locality two specimens were received. One is an extremely hard and compact limestone, of a pale brown color, and crowded with the carapaces of Ostracoda. This rock appears to have undergone a certain amount of compression, for the surfaces of the Ostracod-valves are impressed and indented by one another; and it is due to this fact that not very many valves were obtained from this specimen, which could be definitely described. The other specimen is from a friable calcareous rock of an ocherous brown color. This rock is almost entirely made up of the valves of Ostracoda.

"No. 587. Railroad cut, one-eighth of a mile north of Bryant station, C. & N. R. R., San Pablo Valley." This somewhat shaley argillaceous sandstone, of a bluish-grey color, yielded only a few separate valves of Ostracoda.

---

*"The geology of the region in which this series occurs has been subjected to detailed study by Professor Lawson, who is preparing a monograph on the subject."—J. C. M.

†The numbers here used refer to numbered fossil localities, a record of which is kept at the State University.

"No. 589. Wild Cat Cañon, one-fourth of a mile south of the Caves." This is a greenish-grey marl in which occur bands of Ostracod valves thickly massed together.

"No. 26. East side of San Pablo Ridge, one and three-fourths miles northwest of Orinda Park." A dark, impure-looking limestone crowded with Ostracoda very perfectly preserved and stained nearly black.

"No. 297. Bollinger Cañon, twelve miles southeast of Berkeley." A pale ocherous limestone, somewhat friable, and largely composed of the valves of Ostracoda.

All of the Ostracoda here described are such as inhabit fresh water at the present day, with the exception of *Cypridopsis*, which is as often found in brackish water. They are comprised in the family of the CYPRIDÆ.

It should, however, be borne in mind that in describing Ostracoda from the carapaces alone, and without any of the soft parts, the determination of species and even genera is more or less provisional.

I will here express my indebtedness to Prof. T. Rupert Jones, who has aided me greatly in regard to points of affinity respecting these specimens, as well as by his generous and invaluable advice throughout the writing of this paper.

DESCRIPTIONS.

Cypria, Zenker, 1854.

Cypria subangulata, sp. nov., plate 3, figs. 1–3.

Valves subreniform; greatest height slightly more than half the length. Anterior end broader than the posterior; both rounded, excepting at the antero-ventral region, where the outline forms a blunt angle. The dorsal edge is subangulate a little in front of the middle; the ventral edge slightly sinuous behind the middle. The valves are steeper towards the ventral margin. Length, one-fortieth of an inch; height, one-seventy-second of an inch.

This species resembles *Cypria lævis* (O. F. Muller)* in the subangulate character of the dorsal margin. It differs markedly from that form, however. in the great compression of the valves as seen edgewise, the anterior end being quite sharp. In this latter characteristic the form reminds one of *Cypria Ophthalmica* (Jurine);† but distinctly differs from it in the general outline of the valves.

Cypris subangulata occurs at locality No. 589, Wild Cat Cañon, where it is rare; and at locality No. 26, San Pablo Ridge, fairly common.

Cyclocypris, Brady and Norman, 1889.

Cyclocypris Californica, sp. nov., plate 3, figs. 4–6.

Valves sub-ovate tumid. The posterior end broad and well-rounded. The anterior edge meets the ventral margin somewhat sharply, forming a decided angle. The dorsal margin strongly curved, the ventral hollow towards the middle. In edge view the carapace is rounded posteriorly and the anterior end is obtuse. Length, one-twenty-fifth of an inch; height, one-fortieth of an inch.

Cyclocypris globosa (G. O. Sars)‡ differs from the above species in having both the anterior and the posterior ends of the valves narrower, and the dorsal margin more strongly arched; the thickness of the carapace is uniformly greater than in *C. Californica*.

This species, of which only one specimen was found, occurred at locality No. 589, Wild Cat Cañon.

Cypris, Müller, 1785.

Cypris procera, sp. nov., plate 3, figs. 7–9.

Valves elongate reniform. Length, nearly twice as great as the height. Greatest height slightly in front of the middle. The

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**Cypris lævis*, Müller, 1785, Entom., p. 52, pl. III, figs. 7–9. *C. ovum*, Brady, 1868, Mon. Rec. Brit. Ostrac., p. 373, pl. XXIV, figs. 31–34, 43–45, and pl. XXXVI, fig. ∞

†*Monoculus ophthalmicus*, Jurine, 1820, Hist. des Monocles, p. 178, pl. XIX., figs. 16, 17. *Cypris compressa*, Brady, Crosskey and Robertson, 1874, Monog. Postert. Entom., p. 123, pl. I, figs. 5, 6.

‡*Cypris globosa*, G. O. Sars, 1863, Om en i Sommeren, 1862, foretagen Zoologisk Reise i Christianias og Trondhjems Stifter, p. 127. *Cyclocypris globosa*, Brady and Norman, 1889, Trans. R. Dublin Soc., ser. II, vol. IV, p. 71, pl. XIV, figs. 1, 2.

anterior and posterior extremities compressed and sharp. Dorsal margin well arched; ventral margin slightly hollow; ventral edges of valves sinuous and mutually overlapping. End view of carapace, ovoid, but pointed. Length, one-twentieth of an inch; height, one-thirty-sixth of an inch. In general outline this Ostracod shows some resemblance both to *Cypris virens* (Jurine),[*] and to *Cypridopsis* (?) *Newtoni*, Brady and Robertson.[†] As regards the first-named, however, our specimens are too low, the dorsal margin is not so strongly curved, and the posterior margin is less rounded and narrower. Whilst as distinguished from the latter form, the Californian specimens have more evenly pointed ends, with the posterior region scarcely thicker than the anterior; and, moreover, the anterior border of the valve is more evenly rounded. It is difficult to determine without doubt the generic affinities of these specimens, but they probably present most points of resemblance to the genus *Cypris*, and, moreover, show the feeble overlapping of the edges o the valves, which is somewhat characteristic of the genus.

Cypris procera was found at locality No. 589, Wild Cat Cañon, one specimen; and at locality No. 297, Bollinger Cañon, one specimen.

Erpetocypris, Brady and Norman, 1889.

Erpetocypris Merriamiana, sp. nov., plate 3, figs. 10–12.

Shell laterally sub-reniform, highest at the middle. Anterior and posterior extremities obliquely rounded. Dorsal margin strongly arched; ventral border sinuous, hollowed near the middle. The antero-dorsal region depressed and hollowed. Ventral edge view sub-pyriform; well rounded and swollen at the posterior end, and tapering to a sharp edge anteriorly. Length, one-seventeenth of an inch; height, one-thirtieth of an inch.

This striking species does not exactly correspond with any of our recent types, but seems to be not far removed from *Erpetocypris tumefacta* (Brady and Robertson).[‡]

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[*] See Brady, Crosskey, and Robertson, 1874, Mon. Post-tert. Entom., pl. II, figs. 27, 28.

[†] *Idem*, *ibid.*, pl. II, figs. 20, 21.

[‡] See Brady and Norman, 1889, Trans. R. Dublin Soc., ser. II, vol. IV, p. 87, pl. VIII, figs. 5–7.

The hard limestone from locality No. 585, Wild Cat Cañon, is for the greater part composed of the carapaces of this species. It is also found in the friable specimens from the same locality, where it is common; and at locality No. 297, Bollinger Cañon, where it again forms the greater part of the rock.

Erpetocypris lata, sp. nov., plate 3, figs. 13–15.

Valves bean-shaped laterally. Dorsal edge strongly arched and rounded off towards the ventral side, which is nearly straight. In edge view this form somewhat resembles the previous one, but the carapace is not so full in *E. lata*, and the posterior extremity not so well rounded in the aspect mentioned. Length, one-twelfth of an inch; height, one-twenty-fifth of an inch.

At locality No. 585 this species is frequent; and at locality No. 297, Bollinger Cañon, two specimens.

Cypridopsis, Brady, 1868.

Cypridopsis pliocænica, sp. nov., plate 3, figs. 16–18.

Valves sub-ovate, ends evenly rounded; highest, near the anterior end of the valve. Dorsal edge strongly curved; ventral margin straight. Carapace somewhat compressed, but with the ventral border fairly steep, or blunt in edge view. Length, one-twenty-sixth of an inch; height, one-forty-fourth of an inch.

The above form appears to be closely allied to *Cypridopsis vidua* (Müller)* in their general outline; but the two forms have many points of difference. The carapace of *C. pliocænica* is compressed as compared with *C. vidua*. In the latter species also the ventral margin is incurved, whilst that of *C. pliocænica* is nearly straight.

It is interesting to note here that the genus *Cypridopsis* contains species which are found in brackish as well as fresh water.

C. pliocænica was found at locality No. 587, San Pablo Valley, two specimens.

Candona, Baird, 1850.

Candona candida (Müller), var. *depressa*, nov., plate 3, fig. 19.

This is a variety not altogether unlike *C. candida* var. *tumida*,

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**Cypridopsis vidua*, Brady, 1868, Mon. Rec. Brit. Ostrac., p. 375, pl. XXIV, figs. 27–36, 46.

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Brady and Robertson,* in general outline, although our specimen is less regular in shape, having a sinuosity on the dorsal edge a little in front of the middle, whilst the ventral edge is more or less flexed along its length. The carapace also is greatly compressed as compared with the above-mentioned variety. The carapace is highest just behind the middle. Length, one-fifteenth of an inch; height, one-twenty-seventh of an inch.

One specimen was found at locality No. 589, Wildcat Cañon.

Candona lactea, Baird, var. *acuminata*, nov., plate 3, figs. 20–22.

This variety differs from recent specimens of the type form in having a distinctly acuminate front to the carapace. Otherwise it appears in its lateral aspect to agree with the figures given under the name of *C. detecta*,† but latterly referred to the species *C. lactea*.‡ Length, one-twenty-fifth inch; height, one-forty-second inch.

C. lactea, var. *acuminata*, is very rare at locality No. 585, Wildcat Cañon, opposite the Caves; at locality No. 26, San Pablo Ridge, it is frequent; and at No. 297, Bollinger Cañon, it is rare.

Candona gracilis, sp. nov., plate 3, figs. 23–25.

Shell in lateral aspect long elliptical, rounded at both ends. Dorsal border well arched, ventral border slightly incurved. The edge view shows that the carapace is fullest in front of the posterior third, and that both ends are acuminate. Length, one-thirty-eighth of an inch; height, one one hundred and fifteenth of an inch.

Among the elongate forms of *Candona* there are none so regularly elongate as the above, but of the attenuate and fabiform examples, *C. acuminata* (Fischer)§ may be especially mentioned.

The above species was found at locality No. 589, Wildcat Cañon.

London, England, May, 1896.

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*Ann. Mag. Nat. Hist., ser. IV, vol. VI, 1870, p. 16, pl. IX, figs. 13–15. See also Brady and Norman, Trans. R. Dublin Soc., ser. II, vol. IV, 1889, p. 98, pl. X, figs 14–17.

†See Brady, Crosskey, and Robertson, 1874, p. 134, pl. I, figs. 7–9.

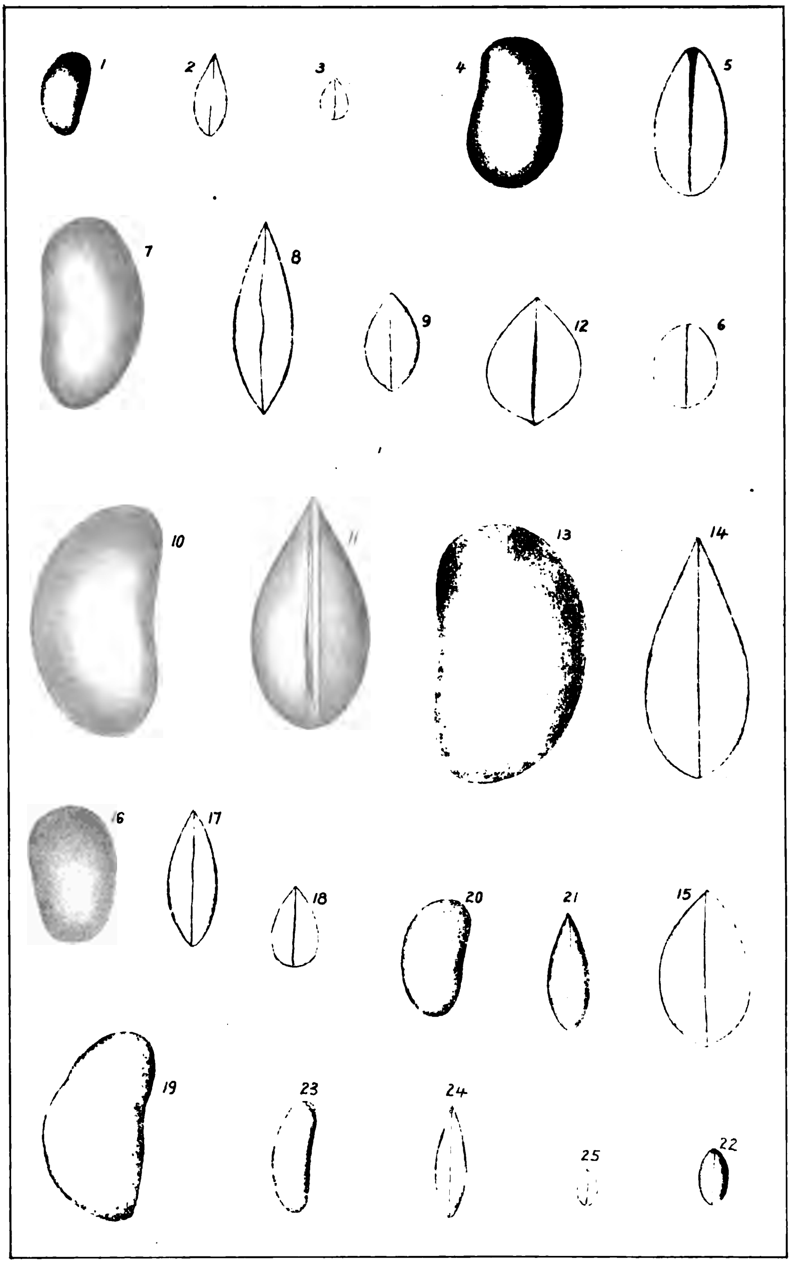
‡Brady and Norman, 1889, Trans. R. Dublin Soc., ser. II, vol. IV, p. 100.

§See Brady and Norman, Trans. R. Dubl. Soc., ser. II, vol. IV, 1889, pp. 104, 105, pl. IX, figs. 9, 10; pl. X, figs. 5, 6.

EXPLANATION OF PLATE 3.

The figures in this plate represent the valves and carapaces with the anterior end upwards. The height of the valves is therefore shown by the transverse width in the figures. In the edge views the tranvserse width is the thickness.

UCMus. 35094 FIGURE 1.—*Cypris subangulata*, sp. nov. Lateral view, right valve. × 18.
FIGURE 2.—*Cypris subangulata*, sp. nov. Edge view. × 18.
FIGURE 3.—*Cypris subangulata*, sp. nov. End view. × 18.
35095 FIGURE 4.—*Cyclocypris Californica*, sp. nov. Lateral view, left valve. × 20.
FIGURE 5.—*Cyclocypris Californica*, sp. nov. Edge view. × 20.
FIGURE 6.—*Cyclocypris Californica*, sp. nov. End view. × 20.
35096 FIGURE 7.—*Cypris procera*, sp. nov. Lateral view, left valve. × 20.
FIGURE 8.—*Cypris procera*, sp. nov. Edge view. × 20.
FIGURE 9.—*Cypris procera*, sp. nov. End view. × 20.
35097 FIGURE 10.—*Erpetocypris Merriamiana*, sp. nov. Lateral view, right valve. × 20.
FIGURE 11.—*Erpetocypris Merriamiana*, sp. nov. Edge view. × 20.
FIGURE 12.—*Erpetocypris Merriamiana*, sp. nov. End view. × 20.
35098 FIGURE 13.—*Erpetocypris lata*, sp. nov. Lateral view, left valve. × 20.
FIGURE 14.—*Erpetocypris lata*, sp. nov. Edge view. × 20.
FIGURE 15.—*Erpetocypris lata*, sp. nov. End view. × 20.
35099 FIGURE 16.—*Cypridopsis pliocænica*, sp. nov. Lateral view, left valve. × 20.
FIGURE 17.—*Cypridopsis pliocænica*, sp. nov. Edge view. × 20.
FIGURE 18.—*Cypridopsis pliocænica*, sp. nov. End view. × 20.
35100 FIGURE 19.—*Candona candida* (Müller), var. *depressa*, nov. Lateral view, right valve. × 15.
35101 FIGURE 20.—*Candona lactea* (Baird), var. *acuminata*, nov. Lateral view, right valve. × 15.
FIGURE 21.—*Candona lactea* (Baird), var. *acuminata*, nov. Edge view. × 15.
FIGURE 22.—*Candona lactea* (Baird), var. *acuminata*, nov. End view. × 15.
35102 FIGURE 23.—*Candona gracilis*, sp. nov. Lateral view, right valve. × 23.
FIGURE 24.—*Candona gracilis*, sp. nov. Edge view. × 23.
FIGURE 25.—*Candona gracilis*, sp. nov. End view. × 23.



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BY FREDERICK CHAPMAN,
PALÆONTOLOGIST TO THE NATIONAL MUSEUM, MELBOURNE; ASSOC. LINN. SOC. LOND.; F.R.M.S.

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CORRIGENDA.

PAGE 20, line 11, for "Petrefactiæ," read "Petrefacta."
,, 31, line 9, for "39, 43," read "39-43."
,, 37, line 13, for "P. VI," read "Pl. III."
,, 40, line 24, for "Petrefactiæ, read "Petrefacta."
,, 42, line 8, for "Pl. V," read "Pl. IV."
,, 42, line 9, for "63a-64, 65 (juv.)," read "63a, 64-65 (juv.)."
,, 44, footnote, for "Petrefactiæ," read "Petrefacta."
,, 48, ,, ditto.
,, 49, ,, ,,
,, 50, space between descriptions of Modiolopsis melbournensis and M. complanata.
,, 55, footnote, for "Petrefactiæ," read "Petrefacta."

A MONOGRAPH OF THE SILURIAN BIVALVED MOLLUSCA OF VICTORIA, IN THE COLLECTION OF THE NATIONAL MUSEUM, MELBOURNE.

By Frederick Chapman, Palæontologist to the National Museum, Melbourne; Assoc. Linn. Soc. Lond.; F.R.M.S.

INTRODUCTION.

SOURCES OF THE PRESENT COLLECTION.

A large proportion of the fossil specimens described herein was collected during the first Geological Survey of Victoria, under the direction of Mr. (afterwards Sir) A. R. C. Selwyn; and was deposited in the National Museum, Melbourne, then under the directorship of Professor (afterwards Sir) Frederick McCoy, who was at the time also palæontologist to the Survey.

Very few of the specimens were identified by McCoy:—a single species described in his Prodromus of the Palæontology of Victoria* under the name of *Cardium gippslandicum* [= *Panenka gippslandica*], and some fossils generically determined for future labelling as *Orthonotus*, *Anodontopsis*, *Leptodomus*, *Arca*, *Aviculopecten and Avicula*, appear in the Museum collections.

On the ¼ sheet No. 1 N.W. Melbourne, McCoy noted the following bivalved genera from Moonee Ponds Creek ("Royal Park"), viz., *Sanguinolites* (= *Orthonota australis* sp. nov.) and *Cucullella* (= *Nuculites maccoyianus*, sp. nov.).

The fossil referred to under the MS. name of *Orthonotus subrigidus* by McCoy on ¼ sheet No. 4 S.W. Geol. Surv. Vict. is now shown, by the hinge structure, to be identical with *Nucula lamellata*, J. Hall, and not allied, as McCoy supposed, to *Orthonota rigida* Sow. sp. of the Upper Llandovery and Lower Ludlow of Great Britain. On the same geological map a *Leptodomus* allied to *amygdalinus* is noted by McCoy. This is now shown to be a distinct species, here named *Leptodomus maccoyianus*. Certain fossils named in MS. by McCoy as *Arca* spp. are herein described as *Nucula opima*, J. Hall, var.

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* Decade VI., 1879, p. 23, Pl. LVI.

australis, nov., and ? *Parallelodon kilmoriensis*, sp. nov. The *Cucullella*, sp., noted on ¼ sheet 3 N.E., by McCoy, I have now referred to *Nuculites coarctatus*, Phillips sp.

The following genera of bivalved shells have been recorded from the Silurian ("Upper Silurian") of Victoria by McCoy, in Progress Report, Geol. Surv. of Victoria, No. 1, 1874, p. 34.

Cucullella, 2 spp. [= *Nuculites*].
Arca, sp. [= *Nucula* and ? *Parallelodon*].
Avicula, 2 spp. [= *Actinopteria*].

The fossil (No. 3368, Mines Dept.) alluded to by McCoy, in Progress Report No. IV., 1877, p. 156, as "a small Aviculoid shell allied to *Ambonychia* (new species)", is here described and figured as probably a young form of a new species—*Lunulicardium antistriatum.*

Three species of Silurian pelecypoda, which had already been described by the Rev. A. W. Cresswell, M.A.,* have been presented by him to our collection. These are *Conocardium bellulum* and *C. costatum*, originally described under the generic name *Pleurorhynchus;* and *Pterinea tatei*, previously described as an *Ambonychia*, but probably identical with *P. lineata*, Goldfuss.

The larger part of the remainder of these Silurian bivalved shells has been obtained from the richly fossiliferous mudstones at South Yarra over the area of the Yarra Improvement Works. They were chiefly collected by Mr. F. P. Spry (now of the National Museum). Other gentlemen who have kindly assisted us in obtaining new material are Messrs. J. T. Jutson, and A. E. Kitson, F.G.S., whilst the opportune donation from Mr. Thos. Warr, of material from a well-boring at Croydon,† has resulted in the addition of several new and remarkable forms of aviculoid and other shells. In addition to the species previously mentioned, we are also indebted to the Rev. A. W. Cresswell, M.A., for a valuable collection of mudstone fossils from near Lilydale,‡ which has furnished us with several additional forms to our list of species.

SOME GENERAL ASPECTS OF THE SILURIAN BIVALVED FAUNA.

The collection now described comprises 62 species and varieties, referred to 29 genera. Of the total number, as many as 58 species and varieties are here recorded from the Victorian

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* Proc. Roy. Soc. Vict., Vol. V., N.S., 1893, pp. 43, 44.

† For a preliminary description of this collection see Victorian Naturalist. Vol. XXIII., 1906, pp. 237-239.

‡ See Mr. Cresswell's remarks on the fossils and the precise localities in Proc. Roy.—Soc., Vict., Vol. VI., N.S., 1894, p. 156.

Silurian for the first time, whilst 14 genera are new to Australia. These newly recorded genera are—*Palæanatina*, *Cardiola*, *Panenka*, *Paracardium*, *Prælucina*, *Ctenodonta*, *Nuculites*, *Nucula*, *Parallelodon*, *Actinodesma*, *Lunulicardium*, *Mytilarca*, *Glossites* and *Cypricardinia*.

The following notes on the above-named genera are compiled in order to show how interesting is the question of the distribution of the bivalved fauna of the Australian Silurian. When our knowledge of this group and of the remainder of the molluscan classes is more complete, it will be possible to make some valuable deductions as to the general relationship of this widely distributed phylum of the animal kingdom, both from geological and geographical stand-points.

Palæanatina, J. Hall.—Hitherto found only in the Upper Devonian of North America.

Cardiola, Broderip.—This is a Silurian genus in Great Britain; and it also occurs in the Silurian and Devonian in Eastern Europe. It appears to be absent from North America, although the somewhat closely associated genus, *Panenka*, is found there in Devonian strata.

Panenka, Barrande, is both a Silurian and Devonian genus, but attains its maximum development in the latter formation.

Paracardium, Barrande.—This genus occurs in the Silurian (Stage E) in Bohemia, and in the Devonian of North America.

Prælucina, Barrande.—A well-defined generic group in the Silurian and Devonian of Bohemia. Barrande notes the total absence of the genus in the Stage Ee_1, but in the Upper Silurian Ee_2 there occur 25 species, whilst in the lowest zone of the Devonian, Ff_1 there are only two species.

Ctenodonta, Salter, is already known elsewhere from the Silurian, and its range extends to the Carboniferous.

Nuculites, Conrad.—A Silurian and Devonian genus, well-represented in the Devonian of South Africa and South America.

Nucula, Lamarck.—This genus ranges from Silurian to Recent. Probably many of the British Silurian species now referred to *Ctenodonta* may prove eventually to belong to this genus. Although originally described as species of *Nucula*, some of these fossils appear to have been transferred to *Ctenodonta*, on insufficient evidence of the hinge characters.*

Parallelodon, Meek and Worthen.—It is interesting to record this genus from the Silurian of Victoria, since it had an already-known range from the Devonian to Tertiary.

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* Compare remarks by J. L. Lobley, on "Palæozoic Arcidæ," Proc. Geol. Assoc., Vol X., No. 8, 1888, p. 402.

Actinodesma, Sandberger.—Although the hitherto-recorded range of this genus is restricted to the Devonian, there is very little doubt that it is represented in the Silurian (Upper Ludlow) of Wales by the so-called "*Avicula*" *or* "*Pterinea*" *ampliata*, to which our fossil bears a close resemblance.

Lunulicardium, Münster.—This genus is confined to the Silurian and Devonian. In Bohemia it is found throughout both formations; in North America only in the Devonian.

Mytilarca, J. Hall.—Well-represented in the Devonian of North America. It occurs in the Silurian (Wenlock shale) in England, usually referred to as *Mytilus.* The British Silurian fossil recorded as *Mytilus chemungensis* seems to differ from the species originally described by Conrad from the North American Devonian. The genus occurs in the upper division (Yeringian) of the Victorian Silurian.

Glossites, J. Hall.—Fossils of Devonian age in North America (Corniferous Limestone to Waverly Group); and in South Africa (Bokkeveld Beds).

Cypricardinia, J. Hall.—This interesting genus ranges through the Silurian and Devonian, both in Europe and North America. It is here confined to the upper beds of the Silurian.

An inquiry into the number and distribution of the Victorian species which are also found elsewhere in homotaxial or closely-related strata, affords some interesting data. There are no less than eleven species of Silurian bivalves (18 per cent.) in our Victorian rocks which can be identified with fossils found in other, often widely separated areas. Regarding the occurrences of similar fossils in Great Britain, shown by the subjoined table, it will be noticed that, with few exceptions, the distribution ranges through the Wenlock and Ludlow series, whilst in Germany and Bohemia the fossils occur in the Lower and Middle Devonian.* The species of bivalved mollusca which occur in North America are found in the Middle Devonian, but not below it, whilst one of our forms is also found there in Upper Devonian rocks. From this the inference may be drawn, that since both in Western Europe and Australia the species made their first appearance in the Silurian, the point of dispersal would probably be situated mid-way between those places, provided the conditions were equal, and that there were no barriers to their migration. The data given below would also appear to imply that considerable obstacles *did* exist against their dispersal along the radius extending to Eastern Europe (Germany and Bohemia); and in the same proportion complex and adverse conditions probably obtained on the migratory path to North America.

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* Cf. Barrande, Syst. Sil. Bohême, Pt. 1, Vol. VI., Acéphalés, 1881, p. 304. (Stage F, included in the Silurian by Barrande, is now referred to the Lower Devonian.)

Further proof of the general trend of these comparative data as derived from other groups of the Victorian Silurian Mollusca is shown in the Museum collections; one notable example being the occurrence of a gasteropod, *Euomphalus disjunctus*, J. Hall,* in the Victorian Yeringian division of the Silurian, specimens of which are inseparable from the shells described by Hall, from the Lower Helderberg of New York (L. Devonian). The Pteropod, *Coleolus aciculum*, J. Hall† of the Middle Devonian (Genessee Slates) of North America, has a close relation in a form which may eventually prove to be identical, and which is not uncommon in the Melbournian shales of South Yarra.‡

Comparative Table of Victorian Species of Silurian Pelecypoda, identical with those found elsewhere.

Genera and Species.	Division.	Foreign Area.	Formation.
Cardiola cornucopiæ, Goldfuss sp. (*C. interrupta*, Sow.)	Melbournian	Europe ...	Silurian
Prælucina ancilla, Barrande	Yeringian ...	Bohemia ...	L. Devonian
Nuculites coarctatus, Phill. sp.	Melbournian	Great Britain ...	Sil. (Ludlow)
Nucula lamellata, J. Hall	,,	North America	Mid. and Up. Devonian
Pterinea lineata, Goldfuss	Yeringian ...	Great Britain ... Germany ...	Silurian (Ludlow) L. Devonian
? *Pterinea tenuistriata*, McCoy	Melbournian	Great Britain ...	Sil. (Wenlock to Up. Ludlow)
? *Ambonychia acuticostata*, McCoy	Yeringian ...	Wales ...	Sil. (Wenlock and L. Ludlow)
Actinopteria texturata, Phill. sp.	,,	England (Devonshire)	Mid. Devonian
A. boydi, Conrad sp.	,,	England ... North America	Sil. (Up. Ludlow) M. Devonian
Modiolopsis complanata, Sow. sp.	Melbournian	Great Britain ...	Sil. (Wenlock to passage beds)
Cypricardinia contexta, Barr.	Yeringian ...	Great Britain ... Bohemia ...	Sil. (Wenlock and L. Ludlow) L. Devonian

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* Pal. New York, Vol. III., 1859, p. 340, Pl. LXV., Fig. 8; Pl. LXVIII., Fig. 4*a*, *b*.
† Pal. New York, Vol. V., Pt. II., 1879, p. 187; Pl. XXXIIA., Figs. 11-15.
‡ Proc. R. Soc. Vict., Vol. XVI., Pt. II., N.S., 1904, p. 339; Pl. XXXI., Fig. 7.

The large majority of the species of Silurian bivalves herein described are in more or less close relationship with those found elsewhere; at the same time they appear to be sufficiently distinct to warrant their separation as new species. When closely examined, the data afforded by these "paramorphs" or allied forms, are of the greatest interest; for these, as well as the more cosmopolitan species above enumerated, shed considerable light upon the generally obscure questions regarding the relationship of our Australian palæozoic faunas to those of other areas.

The subjoined table is an attempt at giving a synopsis of the species described from other areas, which, apparently, are most closely related to the Victorian Silurian pelecypoda. A glance at this table will suffice to show that, as in the former table of identical species, the general aspect is nearly the same with regard to the several areas known elsewhere.

In Great Britain and Ireland some of our species find their affinities with Upper Ordovician forms (very rarely), with Silurian, Llandovery to Ludlow (commonly), and in the Devonian (very rarely). In Germany related species occur in the Devonian (very rarely).

In Bohemia their relationships are found in typical Silurian and Lower Devonian strata (rarely).

In Canada, a single allied form occurs in the Silurian.

In the United States the many related forms range through the Devonian, from the Hamilton to the Waverley groups; whilst only one species having related characters is found in the Upper Ordovician.

The question as to whether the Lower Helderberg group in North America should be correlated with the Devonian, as maintained by Continental geologists, who recognise in it the equivalent of the Coblenzian; or with the Silurian, as held by American geologists, is a difficult point to determine. The fauna of the uppermost beds of the Silurian in Victoria seems to support the American geologists to some extent; for it includes many types of trilobites, many representatives of the *Capulidæ*, and certain spirifers which, although characteristic of the Hercynian fauna of Europe, are also Helderbergian in aspect. There seems, therefore, as much evidence in support of the one opinion as the other, and it is merely a question of recognising the possibility of the subsequent migration to another area of a distinctive fauna, with a minimum amount of change in its facies.

Comparative Table of Victorian Species of Silurian Pelecypoda, related to forms found elsewhere.

Australian Species.	**Related Species.**
Orthonota australis, sp. nov. (Melbournian).	*O. extrasulcata*, Salter. Upper Ludlow, England.
Grammysia cf. *arcuata*, Conrad sp. (Yeringian).	*G. arcuata*, Conrad sp. Hamilton group; North America.
G. aff. *plena*, J. Hall (Melbournian).	*G. plena*, J. Hall. Chemung and Waverley groups; North America.
Leptodomus maccoyianus, sp. nov. (Melbournian).	*Grammysia subarcuata*, J. Hall, Chemung group; North America.
L. heathcotiensis, sp. nov. (Melbournian).	*Leptodomus truncatus*, McCoy. Up. Ludlow; England.
Palæanatina cf. *solenoides*, J. Hall (Melbournian).	*P. solenoides*, J. Hall. Chemung group; North America.
Edmondia perobliqua, sp. nov. (Melbournian).	{*E. obliqua* {*E. subovata*} J. Hall, Chemung group; N. America.
Panenka planicosta, sp. nov. (Yeringian).	*P. nana*, Barrande. Silurian; Bohemia.
Paracardium filosum, sp. nov. (Yeringian).	*P. filiferum*, Barrande. Silurian; Bohemia.
Ctenodonta portlocki, sp. nov. (Melbournian and Yeringian).	*Arca* [*Ctenodonta*] *dissimilis*. Portlock. Up. Ordovician; Ireland.
Nuculites maccoyianus, sp. nov. (Melbournian).	*N. oblongatus*, Conrad. Hamilton group; North America.
N. subquadratus, sp. nov. (Melbournian).	*N. nyssa*, J. Hall. Hamilton group; North America.
N. jutsoni, sp. nov. (? Yeringian)	*N. oblongatus*, Conrad. Hamilton group; North America.
Nucula melbournensis, sp. nov. Melbournian).	*Nucula bellistriata*, Conrad sp. Hamilton group; North America
N. umbonata, sp. nov. (Melbournian).	*N. varicosa*, J. Hall. Hamilton group; North America.
N. arcæformis, sp. nov. (Melbournian).	*N. subæqualis*, McCoy sp. Up. Llandovery; England.
N. taylori, sp. nov. (Melbournian).	*N. anglica*, d'Orbigny. Up. Ordovician and Silurian; England.
N. opima, J. Hall, var. australis, nov. (Melbournian and Yeringian).	*N. nyssa*, J. Hall. Hamilton group; North America.
N. cf. *lirata*, Conrad sp. (Melbournian).	*N. lirata*, Conrad sp. Hamilton group; North America.
Palæoneilo victoriæ, sp. nov. (Melbournian).	*P. muta*, J. Hall. Hamilton group; North America.
P. raricostæ, sp. nov. (Yeringian).	*P. muta*, J. Hall. Hamilton group; North America.
P. producta, sp. nov. (Melbournian).	*P. elongata*, J. Hall. Chemung group; North America.
P. ? *constricta*, Conrad sp. (Melbournian).	*P. constricta*, Conrad. Hamilton, Portage, and L. Chemung groups; North America.
P. cf. *brevis*, J. Hall (Melbournian).	*P. brevis*, J. Hall. Chemung group; North America.

COMPARATIVE TABLE OF VICTORIAN SPECIES OF SILURIAN PELECYPODA—*continued.*

Australian Species.	Related Species.
P. cf. *tenuistriata,* J. Hall (Melbournian).	*P. tenuistriata,* J. Hall. Hamilton group; North America.
Lunulicardium antistriatum, sp. nov. (Yeringian).	? *Cardium striatum,* Sowerby. Bala to Up. Ludlow; Great Britain.
Mytilarca acutirostris, sp. nov. (Yeringian).	*M. trigona,* Goldfuss sp. Mid. Devonian; Germany. *M. chemungensis,* of Salter *non* Conrad. Wenlock series; Wales.
Conocardium bellulum, Cresswell sp. (Yeringian).	*C. dipterum,* Salter sp. Up. Ordovician; Scotland.
Actinopteria asperula, McCoy, sp. var. *croydonensis,* nov. (Yeringian).	*A. asperula,* McCoy sp. Up. Ordovician; Wales.
A. heathcotiensis, sp. nov. (Melbournian).	*A. hirundella,* Whidborne. Devonian; England. *A. ventricosa,* Goldfuss sp. Devonian; Germany.
Modiolopsis melbournensis, sp. nov. (Melbournian).	*M. solenoides,* Sowerby sp. Up. Ludlow; England.
M. nasuta, Conrad sp., var. *australis,* nov. (Melbournian).	*M. nasuta,* Conrad sp. Up. Ordovician; North America and Great Britain.
Glossites victoriæ, sp. nov. (Yeringian).	*Glossites depressus,* J. Hall. Chemung group; North America.
Goniophora australis, sp. nov. (Yeringian).	*G. cymbæformis,* Sowerby sp. Silurian; British Islands. *G. consimilis,* Billings. Silurian; Nova Scotia.
G. cf. *glaucus,* J. Hall. sp. (Melbournian).	*G. glaucus,* J. Hall sp. Hamilton group; North America.
Paracyclas siluricus, sp. nov. (Melbournian).	*Paracyclas lineata,* Goldfuss sp. Devonian; Germany. *P. bulla,* McCoy sp. Up. Ludlow; England. Silurian; Ireland. *P. elliptica,* J. Hall. Corniferous limestone and Hamilton group; North America.

No attempt is here made to subdivide the two series of the Victorian Silurian, designated by Prof. J. W. Gregory as Melbournian and Yeringian.* It was evident, during the progress of the present work, nevertheless, that several horizons can eventually be defined, after further detailed work has been done, by conjoining the stratigraphical and palæontological data.

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* Proc. Roy. Soc. Vict., Vol. XV., Pt. II., N.G., 1903, pp. 171, 172.

The life provinces of the various horizons of the Victorian Silurian may then be studied with advantage. As, for instance, that of the sandstone of Moonee Ponds Creek, with their prevailing types of brachiopods and ophiuroids; and the shales and mudstones of South Yarra, with their more abundant bivalve and trilobite faunas. These two areas are apparently on the same stratigraphical horizon, but represent deposits laid down under different lithological conditions.

At present the facilities for examining sections of strata in the various Silurian areas, by means of road and railway cuttings, and by borings, are not so good as in less recently developed countries such as England or the United States, and consequently this renders the work of correlation a difficult task.

DESCRIPTION OF THE SPECIES.

Class **PELECYPODA.**

Family **Solenopsidæ.**

Genus ORTHONOTA, Conrad, 1841.

Orthonota australis, sp. nov. Pl. I., Fig 1.

Description.—Shell large, elongate; dorsal and ventral margins parallel; posterior margin well rounded. From the umbo to the posterior margin slightly more than twice the height of the shell.

Valves rather strongly convex, moderately steep on the ventral margin, and sloping away towards the posterior cardinal area, where they are more compressed.

Beaks situated close to the anterior extremity, rather prominent.

Surface of the valves ornamented with a series of strong concentric sulci, interrupted below the high umbonal ridge by the cincture, which is limited on each side by a furrow.

Measurements.—Approximate (from the specimen figured).

Length, 42 mm.
Greatest height, 18 mm.

Affinities.—A British fossil (found also in Norway and Gotland), which shows some features in common with ours is *Orthonota extrasulcata*, Salter,* occurring in the Upper Ludlow beds, near Kendal. In this species the concentric plications are not nearly so pronounced as in the Australian form. Another species which may be compared with ours is *Orthonota undulata*, Conrad.* This fossil occurs in the Hamilton Group in the United States. Although generally resembling our form, it is not so convex, and it has the concentric furrows undulate in the posterior area of the shell; whilst the portion between the umbonal ridge and the post-cardinal slope is more numerously relieved by radiating folds.

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* Mem. Geol. Surv. G. Brit., Vol. II., Pt. I., 1848, p. 361, Pl. 17, Fig. 3. See also *Grammysia extrasulcata*, Salter sp., McCoy, Brit. Pal. Fossils, 1852, p. 281, Pl. IK. Fig. 29.

Observations.—The *Orthonota* occurring in the Silurian beds at Yass, New South Wales, and recorded by Prof. T. W. E. David† in his geological section of that district as *Orthonota rigida ?* [Sow. sp.] appears to be a new species, judging from a specimen in the National Museum from the Shearsby collection. It is not related in any way to McCoy's Victorian *O. subrigida* (MS.), which is further on shown to be referable to *Nucula lamellata*. Compared with *Orthonota australis*, sp. nov., the Yass specimen is more compressed, and has a more pronounced mesial sinus.

Horizon and Locality.—Silurian (Melbournian), Moonee Ponds Creek, Flemington ("Royal Park"). Two specimens collected by the Geol. Survey of Victoria. [7869 (type), 7870].‡

Family **Grammysiidæ.**

Genus Grammysia, E. de Verneuil, 1847.

Grammysia abbreviata, sp. nov. Pl. I., Fig 2.

Description.—Shell subquadrate, cardinal line arched; ventral margin nearly straight, slightly incurved at the junction with the umbonal depression, the latter meeting the ventral margin a little in front of the median third. Surface of shell rather strongly convex towards the beaks, which are sub-anterior. A sub-umbonal depression in front of the shell makes a slight angularity reaching from the umbones to the antero-ventral margin. In the figured specimen this angularity is emphasized by crushing. From the umbo to the postero-ventral margin there is an obtuse shoulder, and from thence the surface slopes rapidly away to the posterior margin. The presence of the posterior shoulder and the moderately prominent beaks preclude this form from being referred to the genus *Cardiomorpha*, to which it otherwise bears some resemblance. The valves are concentrically striated or finely sulcate, and the character of these surface markings is closely comparable with that seen in the smaller species of *Grammysia* described from the Hamilton Group of North America.

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* Conrad, Geol. Survey, N. York,; Ann. Rep., 1841, p. 51, Pl. —., Fig. 6. J. Hall, Pal. N. York, Vol. V., Pt. I., 1885. Lamellibranch., II., p. 478, Pl. LXXVIII., Figs. 37-42.

† Ann. Rep. Dept. Mines, N.S. Wales, 1882 (1883). Notes to Section across Silurian and Igneous Rocks, Yass.

‡ Registered Nos. in Museum.

Measurements.

Approximate length, 28 mm.
Height, 12 mm.
Thickness (before crushing), probably about 8 mm.

Observations.—The fossil recorded as *? Cypricardia retusa*, Sowerby,* of the Upper Ludlow series of Delbury, near Ludlow, bears a striking resemblance to our species, with the difference, however, that in the latter the beaks are situated farther forward, and the postero-umbonal slope has an accentuated shoulder. Another somewhat allied form is *Grammysia ulrichi*, Clarke,† from the Devonian of Brazil.

Horizon and Locality.—Silurian (Melbournian), Yarra Improvements, S. Yarra. Presented by Mr. F. Spry. [7871.] A somewhat similar form to the above occurs in the Silurian (Yeringian) calcareous shales at Griffith's Kiln, seven miles south of Mansfield., Specimen presented by Mr. E. O. Thiele. [1573.]

Grammysia, cf. *arcuata*, Conrad, sp.

Posidonia? arcuata, Conrad, 1841, Geol. Surv., N. York, Ann. Rep, p. 53.

Grammysia arcuata, Conrad, sp., J. Hall, 1885, Pal. N.Y., Vol. V., Pt. I., Lamell. II., p. 373, Pl. LXI., Figs. 1-9; Pl. LXIII., Fig. 6 ?; Pl. XCIII., Fig. 27.

Observations.—This is an imperfect specimen of a *Grammysia* in olive mudstone; only the anterior half of the valve being preserved. The character of the sharp, concentric folds reminds one of *G. arcuata*, Conrad sp., of the Hamilton Group of N. America.

Horizon and Locality.—Silurian (Yeringian). Wilson's, near Lilydale, Victoria. Presented by Mr. J. T. Jutson. [7872.]

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* Sowerby in Murchison's Silurian System. Pt. II., 1839, p. 609, Pl. V., Fig. 5. (Now referred by some English palæontologists to *Orthonota*, and included with *C. amygdalina*, Sow. sp.

† See Katzer, Grundzüge der Geologie des Amazonasgebietes, 1903, p. 207, Pl. XIV., Fig. 19.

Grammysia, aff. *plena*, J. Hall.

Grammysia plena, J. Hall, 1885, Pal. N.Y., Vol. V., Pt. I., Lamell. II., p. 382, Pl. LXI., Figs. 31, 32.

Observations.—The antero-median area of this fossil exhibits the confluent character of the interrupted concentric folds, also seen in the N. American species quoted above. The folds, moreover, become more prominent and thinner at the anterior end. There is also a faint, but typically placed, cincture, extending from the beak to the ventral margin, behind the middle of the anterior third. *G. plena* occurs in the Chemung and Waverley groups of Burlington, Iowa.

Horizon and Locality.—Silurian (Melbournian). Ranges east of Heathcote. An imperfect specimen in pinkish sandstone. Coll. Geol. Surv. of Vict., B^b 50. [7873.]

Grammysia cuneiformis, R. Etheridge fil.

Grammysia cuneiformis, R. Etheridge fil., 1899, Prog. Rep., No. XI., Geol. Surv., Vict., p. 35, Pl. B., Fig. 10.

Observation.—This species is represented in the collection of the National Museum by a cast of a left valve in pinkish, friable sandstone.

Horizon and Locality.—Silurian (Melbournian), Heathcote. Coll. by Geol. Surv. of Victoria. [7874.]

Genus LEPTODOMUS, McCoy, 1844.

Leptodomus maccoyianus, sp. nov., Pl. I., Fig. 4.

Description.—Valves sub-trigonal, elongate, with the hinge-line and ventral margin approximately parallel; anterior end narrow and truncated below; ventral border sinuous, posterior rounded and truncated towards the cardinal line. Extremities of valves compressed; beaks prominent, sharp and arcuate, directed forward and situated sub-anteriorly. A mesial sinus extends obliquely from the beak to the middle of the ventral border; umbonal slope well-arched. Surface of valves having a series of closely-set, and somewhat irregular, concentric striæ, which in some specimens are merged into concentric ridges. The shell-surface is also marked with faint radial striæ passing across the ridges from the umbo to the ventral border.

Measurements.—Type specimen: Length, 20 mm.; height, 9 mm.; greatest depth of valve, 4.5 mm. Another specimen has: Length, 15 mm.; height, 7 mm.; greatest depth of valve, 4.5 mm.

Affinities.—This type of shell belongs to the group exemplified by *Grammysia subarcuata*, J. Hall,* from the Chemung Group of N. America, especially in having a forwardly projecting beak with the ventral border narrowing anteriorly. Another form also distinctly related, is the *Myacites striatulus* of Römer,† which notably differs in its more depressed beak.

Observations.—It is interesting to record that McCoy, who established this genus, selected the specimen now figured, as an example of *Leptodomus;* it was, however, not specifically determined. This is probably the same form to which McCoy referred in a note on ¼ sheet, 4 S.W. Geol. Surv. of Victoria, as "*Leptodomus* allied to *amygdalinus*."‡ The species named may be allied to Hall's genus *Pholadella.*

It is appropriate to dedicate this species to one who did such signal work in describing many typical genera and species of British palæozoic mollusca.

Horizon and Locality.—Silurian (Melbournian). Type specimen [976] from Broadhurst's Creek, east of Kilmore, Geol. Surv., Vict., $B^{b.}$ 18; north-east of Kilmore, Geol. Surv., Vict., $B^{b.}$ 24. Also west of Mount Disappointment, gully near porphyritic dyke, Geol. Surv. Vict., $B^{b.}$ 16.

Leptodomus heathcotiensis, sp. nov. Pl. I., Fig. 5.

Description.—Shell subtrigonal, elongate, compressed; rounded in front, subtruncated behind; ventral margin more or less parallel with the cardinal border, but slightly incurved, owing to a feeble sinus extending in a vertical line from the beaks to the ventral margin. Beaks anterior, salient, and nearly terminal. Cardinal line straight. Posterior cardinal area hollowed from the beaks to the postero-ventral margin, resulting in a curved umbonal ridge below. Median area depressed. Surface having numerous parallel concentric ridges (about 18 to 20).

Measurements.—Type specimen: Length, 25 mm.; height, about 13 mm.; depth of left valve, 4 mm.

Affinities.—The nearest allied form with ours is undoubtedly McCoy's "*Leptodomus truncatus*,"§ from the Upper

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* Preliminary notice, Lamellibranchiata, 2, 1870, p. 61 : *G.* (*Leptodomus?*) *subarcuata*, J. Hall, Pal. N.Y., Vol. V., Pt. I., 1885, Lamell., II., p. 375, Pl. LXI., Figs. 10-22; Pl. XCIII., Fig. 26.

† Das Rheinische Uebergangsgebirge, 1844, p. 79, Pl. II., Fig. 5. Also Beushausen, Abhandl. Kon. Preuss. Geol. Landesanst, N.F. Heft, XVII., 1895, p. 265, Pl. XXIV., Figs. 12-14.

‡ See Sowerby, in Murchison's Silurian System, 1839, p. 609, Pl. V., Fig. 2—"*Cypricardia amygdalina.*"

§ British Palæozoic Fossils, Pt. II., 1852, p. 279, Pl. IK., Figs. 21-24.

Ludlow of Benson Knot, Kendal, Westmoreland. The characters which separate our species from McCoy's are the depressed umbones and the more closely striated surface in the former. In common with the Ludlow species, the specimens from Heathcote also show the same variation in the length of the shell; our figured type being a rather elongate form.

Horizon and Locality.—Silurian (Melbournian). Ranges east of Heathcote. Coll. of the Geol. Surv. Vict., $B^{b.}$ 50 [987, type]. Also specimens from the same locality presented to the Museum by Mr. J. H. Gatliff.

Genus PALÆANATINA, J. Hall, 1870.

Palæanatina cf. *solenoides*, J. Hall. Pl. I., Fig. 6.

Palæanatina solenoides, J. Hall, 1885, Pal. N.Y., Vol. V., Pt. I., Lamell. II., p. 489, Pl. LXXIX., Figs. 38, 39.

Observations.—The specimen before us is unfortunately incomplete, but there is enough evidence to show that it was thin-shelled, inequivalve, the left valve larger than the right. It bears a fairly close resemblance to the comparatively large, parallel-sided species from the Devonian of N. America, quoted above.

Horizon and Locality.—Silurian (Melbournian). In hard, grey mudstone, S. Yarra. Presented to the National Museum by Mr. A. E. Kitson, F.G.S. [7875.]

Genus EDMONDIA, de Koninck, 1842.

Edmondia perobliqua, sp. nov., Pl. I., Figs. 7, 8; Pl. I., Fig. 9.

Description.—Shell sub-ovate, oblique; thickest in the median and umbonal area. Beaks rather inflated, directed forward, and situated anteriorly. Anterior border short, and truncated towards the ventral margin, curving widely to the posterior extremity, where it turns abruptly upwards to meet the cardinal line. Cardinal border moderately short. In the cast of the shell there is a depression beneath the posterior umbonal slope indicating a ridge or support inside the shell, terminating in a semilunar muscle scar. The posterior area of the shell is compressed, and almost nasute at the postero-ventral margin; and sometimes it is expanded, as in *Ptychodesma*, J. Hall, to which this form shows certain affinities. Surface of shell with fine concentric lines of growth, and obscure radii, especially noticeable on the umbonal slope.

The shell of this species was evidently very thin, since the sculpturing is conspicuous on the casts.

Affinities.—*Edmondia obliqua*, J. Hall* and *E. subovata*, J. Hall,† bear certain close relationship to our species. They both differ, however, in general shape, the former being subquadrate, and the latter lacking the obliquity of the umbonal ridge. Both the above-mentioned species were from the Chemung Group (Upper Devonian) of the State of New York.

Measurements.—Length of type specimen, 22 mm.; greatest height, 15 mm.; thickness of the two valves, about 8 mm.

Horizon and Locality.—Silurian (Melbournian). In pale mudstone, Yarra Improvement Works, S. Yarra, and the dark indurated mudstone of the Domain-road sewerage cuttings, S. Yarra. Not uncommon. The type specimen presented by Mr. F. P. Spry. [7876 (type), 7877, 2239.]

[Genus incertæ sedis.]

Genus SPHENOTUS, J. Hall, 1885.

Sphenotus warburtonensis, sp. nov. Pl. I., Fig. 10.

Description.—[Details from an internal cast.] Elongate-ovate; anterior extremity short, posterior broad and compressed. Beaks prominent, sub-anterior; a well-marked umbonal ridge running from the beaks to the post-ventral border. Cardinal line nearly straight; area having several long, undulose and thin lateral teeth, posteriorly, and two short cardinal teeth beneath the beak. Ventral margin sinuous, incurved towards the middle, where it meets a conspicuous cincture in front of the umbonal ridge. Shell compressed beneath the beaks, and with the margin rounded to the ventral border. A strong adductor impression occurs under the beaks, situated half-way to the ventral angle. Surface of cast marked by strong lines of growth at wide intervals, shown as deep groovings.

Measurements.—Length, 53 mm.; height, 25 mm.; depth of valve, 6 mm.

Observations.—The above species is typical of the genus in all essential details. It differs from *Modiolopsis*, to which genus it might otherwise be readily referred, in having the characteristic lateral teeth and anterior cincture.

It is noteworthy of this genus that elsewhere, as in England and N. America, it has hitherto only been recognised in the Devonian; but its occurrence here, in one of the highest beds of the Victorian Silurian, is not surprising, since we already know that the fauna present in these beds has a strong Devonian aspect, which abnormal feature has led Mr. R. Etheridge, jun., and other Australian palæontologists to refer to such assemblages as Siluro-devonian.

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* Pal. N.Y., Vol. V., Pt. I., 1885. Lamell, II., p. 388, Pl. LXIV., Figs. 15, 16, 23.

† Ibid., p. 389, Pl. LXIV., Figs. 10, 18-21, 26-28.

Horizon and Locality.—Silurian (Yeringian). Reefton, Warburton, Upper Yarra, Victoria. From the Mines Dept., Vict., No. 3431. [2240.]*

Family **Cardiolidæ.**

Genus Cardiola, Broderip, 1839.†

Cardiola cornucopiæ, Goldfuss sp., Pl. I., Figs. 11, 12.

Cardium cornucopiæ, Goldfuss 1837, Petrefactiæ Germaniæ, Vol. II., p. 216, Pl. CXLIII., Figs. 1 *a-e*.

Cardiola interrupta, Sowerby, 1839, in Murchison's Silurian System, p. 617, Pl. VIII., Fig. 5.

Observations.—Our Australian specimens present no differential characters by which they can be even varietally separated from the well-known European species. Numerous examples of *C. cornucopiæ* from Bohemia in the National Museum collection help to confirm the opinion of Sowerby and others regarding the identity of that species with *C. interrupta.*

Although Sowerby's specific name (*interrupta*) is almost universally used for this form, it must unfortunately be set aside for the earlier described *C. cornucopiæ* of Goldfuss. The specific name *C. interrupta,* given by Sowerby (not Broderip, as Fischer in his "Manuel de Conchyliologie," gives it) was not published until two years after that of Goldfuss' description. There was no previous reference to, nor description of, *C. interrupta,* as Murchison would lead one to suppose (see his footnote—Silur. Syst., p. 617); for turning to the Proceedings of the Geological Society of London, Vol. II., under date January, 1834, p. 13, the reference given by Sowerby and Murchison, no allusion to *C. interrupta* is found, while in the Table facing p. 13, Div. I., Ludlow Rocks, we read—"Cardiola," Brod., a new genus, 2 spp. My friend Mr. C. Davies Sherborn, F.G.S., who has been good enough to verify these references, thinks that in all probability the original manuscript of Murchison was abbreviated before publication.

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* In Progress Report No. IV. Geol. Surv., Vict., 1877, p. 156, there occurs a note by McCoy on this and associated fossils, stating them to be of Ludlow age. Even at the present time we cannot speak much more definitely, but judging from the strong Devonian aspect of the fossils they may be even comparable in part to the Dowtonian.

† Recorded as a genus (*nomen nudum*) in 1834, in Murchison, Proc. Geol. Soc., Vol. II., Table, p. 13.

Cardiola cornucopiæ (as *C. interrupta*) has a recorded range in Britain from the Llandeilo to the Upper Ludlow beds.*

Horizon and Locality.—Silurian (Melbournian). In brown and blue shale from the Yarra Improvements, S. Yarra, collected by Mr. F. Spry and the author. Also in brown sandstone, Moonee Ponds Creek, Flemington (" Royal Park "). Coll. by Geol. Surv. Vict. [7878, 987.]

Family **Præcardiidæ.**

Genus PANENKA, Barrande, 1881.

Panenka gippslandica, McCoy, sp.

Cardium gippslandicum, McCoy, 1879, Prod. Pal., Vict., Decade VI., p. 23., Pl. LVI.

Observations.—In describing this fossil under the generic name of Cardium, McCoy wrote:—" Although not quite satisfied with the generic reference to *Cardium*, still it is congeneric with the previously described Upper Silurian Cardiums." At that time the genus to which we now refer it had not been established, but in 1881 Barrande separated those forms with expanded superior margin and strong radial and concentric ornament from *Cardiola*, Broderip, to which the Upper Silurian " Cardiums " were afterwards referred, and placed them under the above generic name. In Victoria, the genus *Panenka* is found associated with Silurian and occasional Devonian forms, in one of the highest group of the Yeringian beds; it is characteristic of the Silurian and Devonian in Bohemia (stages E to G), and of Devonian beds in Devonshire and N. America.

Horizon and Locality.—Silurian (Yeringian). Mt. Matlock; near Starvation Creek; and Russell's Creek, Gippsland. [7486 (type), 7487-88, 2097.]

Panenka planicosta, sp. nov. Pl. I., Fig. 13.

Description.—Shell minute (for this genus), sub-orbicular, oblique; cardinal alæ conspicuous; hinge line nearly straight; ventral border well-rounded, truncated in front and produced behind. Height nearly equal to the length. Beaks prominent, sub-central, slightly anterior, and directed forward. Surface of shell not much inflated, with the greatest convexity towards the middle; ornamented by about 10 flattened riblets on the median area, each having towards the ventral border a distinct groove, becoming evanescent beyond half the length. Postero-dorsal area bearing a few riblets, disappearing toward the beaks.

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* R. Etheridge, Foss. Brit. Ids., Palæozoic, Vol. I., 1888, p. 102.

Measurements.—Length of the type specimen, 4.25 mm.; height, 4 mm.

Observations.—This form might be regarded as the immature shell of *P. gippslandica,* but for the distinguishing feature of the riblets, which are depressed and grooved, whilst in *P. gippslandica* they are simply and sharply ridged.

Affinities.—The nearest related form to the above appears to be Barrande's *Panenka nana,** from Stage E in Bohemia. The chief differences shown in the latter are the more numerous riblets, the narrower interspaces, the double striæ on their surfaces, and the general form of the shell, which is not so depressed; neither are the alæ so well developed as in ours.

Horizon and Locality.—Silurian (Yeringian). In the dark shale of Mt. Matlock, associated with *Tentaculites matlockiensis,* Chapman;† presented by Mr. N. Lepoidivil, in 1877. [7879.]

Panenka cingulata, sp. nov. Pl. I., Fig. 14.

Description.—Shell of medium size, obovate, ventral border evenly rounded, abrupt in front, produced behind. Surface evenly convex in the median area and near the umbones; concave anteriorly, depressed posteriorly. Beaks oblique, pointing forward. Surface ornament consisting of about 26 curved ribs radiating from the umbo, well-rounded, closely set and separated by deep furrows. The ribs are transversely crossed at intervals by the rather deep concentric furrows, which apparently represent distinct stages in the growth of the shell, causing interference with the continuous and even growth of the riblets.

Measurements.—Length, 38 mm.; height about 26 mm.; greatest depth of valve, 5 mm.

Observations.—The regular convexity of the valves, and the rounded ribs render this form easily distinguishable from *P. gippslandica,* McCoy.

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* Syst. Sil. Bohême, Vol. VI., Pt. I., Acephalés, 1881, Pl. 110, Figs. 1-3; Pl. 266, Figs. I., 4-7.

† Proc. Roy. Soc., Vict., Vol. XVI. (new series), Pt. II., 1904, p. 338, Pl. XXXI., Figs. 1, 2, 3, 5.

Horizon and Locality.—Silurian (Yeringian). MacMahon's Creek, Upper Yarra. Coll. by Dept. of Mines (3780) [2263]. Another specimen, probably related to the above species, was presented to the National Museum by Mr. R. Jacob in 1867. This was found at the Caledonian Diggings, One Tree Hill, Christmas Hills, in strata apparently of about the same horizon as that of the type specimen. In this example the shell is higher than the figured type, but this difference may be due to compression; the concentric furrows also are not so well marked. [7880.]

Genus PARACARDIUM, Barrande, 1881.

Paracardium filosum, sp. nov. Pl. I., Figs. 15, 16.

Description.—Shell sub-trigonal, the beaks prominent, ventral margin rounded and expanded. Surface contour well arched, especially in the umbonal region and towards the ventral margin. Surface ornament consisting of about 22 fine, flattened riblets, grooved medially. Cardinal line not perfectly preserved, but apparently less extended than in the previous genus.

Affinities.—The small size of the shell, together with the prominent, incurved umbones, and the sub-truncate posterior, show this fossil to belong to the genus *Paracardium.* It closely approaches Barrande's *P. filiferum** in surface ornament, but differs in the more regular proportion of the fine and coarse riblets. The Bohemian examples occurred in the Silurian (Stage E).

Measurements.—Height, 7 mm.; length, 8 mm.

Horizon and Locality.—Silurian (Yeringian). Starvation Creek, Upper Yarra. Coll. Geol. Surv., Victoria (3779). [7881.]

Genus PRÆLUCINA, Barrande.

Prœlucina ancilla, Barrande. Pl. VI., Figs. 88, 88*a*.

Prœlucina ancilla, Barrande, 1881, Syst. Sil. Bohême, Vol. VI., p. 280, Pl. LXVIII.

Observations.—The occurrence of this species in the palæozoic of Victoria is of some stratigraphic importance, since it is apparently a widely-distributed form, having already been described by Barrande from the lowest bed of the Devonian series in Bohemia, a black limestone (FF_1) resting on Silurian

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* Syst. Sil. Bohême, Vol. VI., Pt. I., 1881, Acéphalés, Pl. LXXV., Figs. II. 1-4.

(Ee_2). Although we have only a mould from a single specimen to judge by, there can be no hesitation in assigning our example to the above species, for it shows the following characters in common with Barrande's figured specimens:—Shell longer than high, sub-oval, truncately rounded in front at the base, boldly curved behind; beaks low, pointed slightly forward, and situated anteriorly. The riblets are numerous (usually about 80), rounded; moderately strong on the basal margin, becoming very fine and almost obsolete towards the umbo. The shell-surface is marked with concentric, inequidistant furrows.

The hinge characters are not shown in any of Barrande's specimens, nor in ours, but in the latter the area on either side of the beaks is marked with several conspicuous short, curved folds or ligamental grooves, more or less parallel with the cardinal border.

Compared with actual Silurian (Stage E in the Bohemian Basin) species of the genus, our specimen differs from the nearest allied form, *P. lustralis** in its more sharply truncated anterior, and higher shell.

Horizon and Locality.—Silurian (Yeringian). Maindample, near Mansfield. Presented by Mr. Hutchinson, per Rev. R. Thom. [7882.]

Family **Ctenodontidæ.**

Genus CTENODONTA, Salter, 1851.

It seems convenient to refer the nuculoid shells without ligament-pit (resilifer) to Salter's genus, whilst the subrostrate forms of the same type find a place in *Palæoneilo* of J. Hall. Some authors, as Beushausen, include both the above-named forms in the one genus.

Ctenodonta portlocki, sp. nov., Pl. II. Figs. 17-20.

Description.—Outline of shell variably elongate-ovate to subquadrate; with moderately high umbones and a prominent cardinal area, the hinge lines sloping away from the umbo. Beaks anterior, the posterior hinge line twice the length of the anterior. Surface of shell concentrically striate, or with shallow concentric grooves.

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* Barrande, op. cit., Pl. LXXI., Figs. 1-13.

Measurements—

Ex. 1. Length, 15 mm. Height, 10.5 mm.
Ex. 2. Length, 10 mm. Height, 8 mm.
Ex. 3. Length, 12.5 mm. Height, 10 mm.

Observations.—The Victorian specimens appear to resemble Portlock's *Arca* [*Ctenodonta*] *dissimilis** from the Upper Ordovician of Tyrone, Ireland, in some particulars, but differ in having a sloping or Λ-shaped cardinal line. In *C. dissimilis* the hinge line is straight, and the area conspicuous.

Horizon and Locality.—Silurian (Melbournian); in the mudstone of South Yarra, type presented by Mr. Spry. Silurian (Yeringian); Wilson's Station, Lilydale, presented by Mr. J. T. Jutson; junction of Woori Yallock and Yarra, B 23, Coll. Geol. Surv. Vict. [7883 (type), 7884-6.]

Genus NUCULITES, Conrad, 1841.

[NOTE.—Certain species from Victoria in the National Museum now described for the first time, were labelled as *Cucullella* by McCoy, and this name was used in the notes on the quarter sheets of the Geological Survey of Victoria. Since Conrad's genus *Nuculites* is essentially the same as McCoy's *Cucullella,* and antedates it by some years, it is obviously the correct one for adoption.]

Nuculites maccoyianus, sp. nov., Pl. II., Figs. 21-23.

Description.—Shell elongate-ovate; variable in size, and to some extent in form. Cardinal line sinuously arched, ventral margin gently and evenly curved, rounded off abruptly at the anterior border; posterior extremity rounded, sometimes compressed, narrow and flange-like. Cardinal area having the characteristic taxodont hinge. Surface moderately convex. highest just below the beaks; the latter are usually depressed and situated sub-anteriorly, projecting slightly forward. Each valve carried an anterior buttress or clavicular ridge immediately in front of the umbones, and there is a distinct posterior adductor impression midway between the beaks and the posterior margin. The specimens found are practically in the form of internal casts and moulds, but the latter show indications of a surface ornamentation of concentric rugæ or lines of growth.

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* Rep. Geol. Londonderry, 1843, p. 428, Pl. XXXIV., Fig. 5.

Measurements.—Smallest specimens, length, 4.5 mm.; height, 3 mm. A large example, length, 12 mm.; height, 7.5 mm. The largest specimen in the present series has a length of 15 mm.

Affinities.—The *Nuculites oblongatus* of Conrad* from the Hamilton Group in North America is, in general features, closely comparable with our species, but differs in having a relatively greater length and a straight ventral margin. With regard to the posterior adductor impression nearly always present in the Victorian species, comparison may be made with a similarly marked fossil shell, *Nuculites colonicus* Reed† from the Bokkeveld beds of Cape Colony.

Horizon and Locality.—Silurian (Melbournian). Very abundant in the ochreous and blue mudstone at the Yarra Improvement Works, S. Yarra, and the Swanston-street sewer near Collins-street; in brown mudstone N. of Yan Yean, Geol. Surv. Vict., coll. $B^{b.}$ 11; and in pale grey mudstone, Merri Creek, Kalkallo, Geol. Surv. Vict., coll. $B^{b.}$ 3; also Silurian (Yeringian), junction of Woori Yallock and Yarra. Geol. Surv. Vict. B 23. [7887 (type), 7888-9, 969-75.]

Nuculites coarctatus, Phillips, sp. Pl. II., Figs. 24, 25.

Nucula coarctata, Phillips, 1848, Mem. Geol. Surv. Gr. Brit., Vol. II., Pt. I., Palæont. Append., p. 366, Pl. XXII., Figs. 1-4.

Cucullella coarctata, Phill. sp., McCoy, 1852, Brit. Pal. Foss., Pt. II., p. 284.

Observations.—This species was originally described from the Ludlow Rocks of Great Britain, and it is therefore interesting to find it also in the Silurian rocks of Victoria. *N. coarctatus* is a somewhat variable species, but is distinguished from the allied form *N. triqueter*, Conrad,‡ from the Hamilton Group of N. America, by the beaks being less pronounced, and the posterior area not so obliquely produced.

Horizon and Locality.—Silurian (Melbournian). In the mudstone of S. Yarra, specimen presented by Mr. F. P. Spry; west of Mount Disappointment; coll. Geol. Surv., Vict., $B^{b.}$ 17. (See note on ¼ sheet 3 N.E., "*Cucullella* sp.") [7890-1.]

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* J. Hall, Pal. N. York, Vol. V., Pt. I., 1885, Lamellibranchiata II., p. 324, Pl. XLVII., Figs. 1-12.

† Annals S. African Museum, Vol. IV., Pt. VI., No. 11, 1904, p. 259, Pl. XXXII., Fig. 1.

‡ Geol. Surv. New York, Ann. Rept., 1841, p. 50. See also J. Hall, Pal. N. York, 1885, Vol. V., Pt. I. Lamell. II., 326, Pl. XLVII., Figs. 17-28, Pl. XCIII., Figs. 8-10.

Nuculites subquadratus, sp. nov. Pl. II., Figs. 26, 27, 27*a*.

Description.—Shell of medium size, subquadrate in outline, narrower anteriorly; the ventral border broadly curved and truncated towards the postero-cardinal angle. Beaks rather prominent, situated sub-anteriorly and directed forward. Anterior buttress impression commencing just in front of the beak, curving slightly, and traversing about two-thirds of the distance to the ventral margin. Posterior adductor impression strong. Surface highly convex; median area near the beaks depressed, curving evenly to the ventral margin, rather steep toward the postero-ventral angle, presenting a decided umbonal slope; depressed immediately below and in front of the beaks. Shell-surface ornamented with closely-set, concentric lines of growth, and crossed by fine striæ, which apparently radiate from the umbo, becoming stronger towards the ventral margin.

Measurements.—(1) Length, 11.5 mm.; height, 9 mm. (2) Length, 6 mm.; height, 5 mm.

Observations.—This species is unusually short, and reminds one of *Arca* in its squareness. The two specimens figured, although differing somewhat in details, are referred to the same species, as they agree in their essential features. In *N. subquadratus* we have a surface ornamentation similar to that seen in some of the better-preserved British specimens of *N. coarctatus*, this feature of the radiating striæ apparently being confined to these two species.

Affinities.—The present species very closely approaches *N. nyssa*, J. Hall,* from the Hamilton Group of N. America, but the latter form is not marked with radiating striæ, nor is it so quadrate in outline.

Horizon and Locality.—Silurian (Melbournian). North of Yan Yean; coll. Geol. Surv., Vict., $B^{b.}$ 11; west of Mount Disappointment, G.S.V., $B^{b.}$ 17. [7892 (type), 977.]

Nuculites jutsoni, sp. nov. Pl. II., Fig. 28.

Description.—Valves ovately elongate, length nearly twice the height. Ventral margin evenly curved; cardinal line slightly arched. Beaks sub-anterior, tumid; anterior extremity broadly rounded and compressed beneath the beaks; posterior extremity narrow, produced, curving upward and forward to meet the cardinal line obtusely. Deepest part of the valve just behind the anterior third. Surface somewhat steeply inclined in front and along the cardinal area, boldly arched in the middle, and thence sloping gently to the back and basal margin. A few faint irregular concentric striæ or growth-lines present. Indications of the anterior buttress just below the umbo; this feature is shown more clearly in another specimen collected from the same locality by Mr. F. P. Spry.

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* Pal. N. York, Vol. V., Pt. I., 1885, Lamell. II., p. 328, Pl. XLVII., Figs. 29, 30.

Measurements.—Height, 7.5 mm.; length, 14 mm.; depth of valve, about 3 mm.

Affinities.—The nearest form to the above appears to be *Nuculites oblongatus*, Conrad,* a fossil of the Hamilton Group of N. America, and already compared with our *N. maccoyianus.* The above species differs, however, from the N. American example in being slightly more convex at the umbones, more strongly curved on the ventral margin, and more attenuated posteriorly. It differs from the previously-described *N. maccoyianus* in the more forward position of the beaks and the acuter posterior extremity.

Horizon and Locality.—Silurian (? Yeringian), Wandong,† Victoria. Presented by Mr. J. T. Jutson. Also from the same locality, presented by Mr. F. P. Spry. [7893 (type), 7894.]

Family **Nuculidæ.**

Genus NUCULA, Lamarck, 1799.

Nucula melbournensis, sp. nov. Pl. II., Figs. 29, 30, 31, 31*a*, (?)32, (?)32*a*, (?)33, (?)33*a*.

Description.—Shell broadly ovate, ventral margins evenly convex; cardinal line oblique, arcuate; anterior end short, obliquely rounded towards the base; posterior end broad and rounded. Beaks prominent, pointing slightly forward, and closely adpressed. Greatest thickness of valves just below the beaks. Surface sculptured by varices or undulæ at more or less equal intervals. Adductor impressions well-marked on the surface of casts.

Measurements.—Type specimen.—Length, 13.5 mm.; height, 10.5 mm.; width of shell near umbones, 6 mm.

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* J. Hall, Pal. N. York, Vol. V., Pt. I., 1885, Lamell. II., p. 324, Pl. XLVII., Figs. 1-12.

† The rock containing the above fossils is a dark brown irregularly bedded sandstone, probably younger than the dark impure limestone with *Dalmanites* found to the westward of the same locality.

Affinities.—This species resembles in outline *N. bellistriata*, Conrad, sp.,[*] from the Hamilton Group of N. America, but lacks the fine concentric sculpturing of the surface seen in the latter.

Observations.—*N. melbournensis* is variable in outline, and although agreeing in general form, a series can be readily collected which shows a regular gradation from narrow-oblong to broadly-ovate, or even sub-orbicular forms. It is abundant in some of the localities around Melbourne, especially in the fine argillaceous shales. So far as we know at present, *N. melbournensis* is confined to the neighbourhood of Melbourne.

Horizon and Locality.—Silurian (Melbournian). Yarra Improvement Works, S. Yarra; Sewerage Works, Domain road, S. Yarra; Swanston-street Sewer, Melbourne; also a doubtful specimen from Merri Creek, Kalkallo (Kinlochewe). Coll. Geol. Surv., Vict., B$^{b.}$ 3. [7895 (type), 7896-8, 985-6.]

Nucula umbonata, sp. nov. Pl. II., Figs. 34, 35.

Description.—Shell sub-trigonal, oblique; strongly convex, especially toward the beaks. Ventral margin gently rounded; anterior border widely curved, sloping steeply and sub-truncated at the junction with the ventral margin; the posterior border is formed by a long curved slope, meeting the ventral margin somewhat abruptly. Beaks not very prominent, incurved, gibbous. Umbonal slope narrowly rounded, extending from the beaks to the postero-ventral margin. Surface of shell marked by several strong concentric varices, between which occur numerous fine growth lines. One specimen shows the ligament-pit (resilifer) very clearly.

Measurements.—Length, 11 mm.; height, 9 mm.; depth of valve, 3.5 mm.

Affinities.—Both in the general form of the shell and its surface ornamentation our species shows some relationship with *N. varicosa*, J. Hall,[†] a fossil from the Hamilton Group of N. America (N. York State). A marked difference, however, exists between them, in that the Australian species has sub-anterior beaks which are not prominently directed forward.

Horizon and Locality.—Silurian (Melbournian). Type specimen from the Police Paddock, Kilmore; coll. Geol. Surv., Vict., B$^{b.}$ 22. Also from the south end of the Reservoir, Yan Yean; coll. Geol. Surv., Vict., B$^{b.}$ 14. [7899 (type), 7900.]

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[*] See J. Hall, Pal. N. York, Vol. V., Pt. I., 1885, Lamellibranchiata II., p. 318, Pl. XLVI., Figs. 1-9.

[†] Pal. N. York, Vol. V., Pt. I., 1885, Lamell. II., p. 319, Pl. XLVI., Figs. 12-23, Pl. XCIII., Fig. 4.

Nucula arcæformis, sp. nov. Pl. II., Fig. 36.

Description.—Shell sub-rectangular, oblong; strongly convex toward the beaks, sloping away toward the ventral margin, which is depressed and almost flange-like. Beaks prominent, sub-central, directed slightly forward. Both extremities vertically truncate and only slightly rounded; ventral margin straight. Surface marked by irregular and somewhat coarse undulations or lines of growth, especially conspicuous near the ventral border.

Measurements.—Length, 15 mm.; height, 10 mm.; depth of valve, about 2.5 mm.

Affinities.—The shape of the valve in this species is peculiarly rectangular, and not quite comparable with any form hitherto figured, the nearest being *Nucula subæqualis*, McCoy, sp.,* from the Upper Llandovery beds of the Malverns and Wales. The latter species, however, is much more gibbous in the umbonal area. A fragment of another valve is fortunately found underlying the figured specimen of *N. arcæformis*, which shows the form of hingement to belong to the genus *Nucula*.

Horizon and Locality.—Silurian (Melbournian). In the hard black shale of the Domain-road Sewer, and the blue mudstone of the Yarra Impt. Works, S. Yarra (coll. by F. P. Spry). Also from Merri Creek, sect. XXVIII., parish of Merriang, and hills east of Creek; coll. Geol. Surv., Vict., B$^{b.}$ 6. [7901 (type), 7902-6.]

Nucula taylori, sp. nov. Pl. II., Figs. 37, 38.

Description.—Shell small, sub-ovate. Beaks prominent, incurved, sub-acuminate, sub-central. Cardinal line strongly arched. Ventral margin gently and evenly rounded, curving boldly anteriorly, and sharply at the posterior extremity, where it is truncated toward the beaks. A well-marked umbonal slope runs from the beak to the postero-ventral margin. Cardinal area on both sides of beak depressed. Surface smooth, or with a few faint lines of growth.

Measurements.—Length, 6.5 mm.; height, 5 mm.

Affinities.—*N. taylori* bears some resemblance to *Nucula anglica*, d'Orbigny,† which ranges from the Caradoc series to the Lower Ludlows in Britain; the chief difference being the greater convexity of our form, especially in the umbonal region.

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* (*Arca subæqualis*) Brit. Pal. Fossils, p. 283, Pl. 1K., Fig. 1. Siluria, 4th ed., Pl. X., Figs. 7, 8.

† Prodr. Pal., p 33, Stage 1, No. 194. *Nucula ovalis*, Sowerby, Sil. Syst., 1839, p. 609, Pl. V., Fig. 8. *Ctenodonta anglica,* d'Orb. sp. Siluria, 4th ed., 1867, Pl. XXXIII., Fig. 10.

Observations.—This species is named after Mr. Norman Taylor, who was attached to the Geological Survey of Victoria, and surveyed the district whence the present specimens came.

Horizon and Locality.—Silurian (Melbournian). Broadhurst's Creek, east of Kilmore; coll. Geol. Surv., Vict., B$^{b.}$ 18; also Yarra Impt. Extension, Hoyt's Paddock, S. Yarra. Presented by Mr. F. P. Spry. [7907 (type), 7908.]

Nucula opima, J. Hall, sp., var., *australis*, nov. Pl. III., Figs. 39, 43.

Cucullæa opima, J. Hall, 1885, Rep. 4th Geol. Distr. N.Y., p. 197, No. 78, Fig. 3 (p. 196).

Nucula randalli, J. Hall, 1885, Palæont. N. York, Vol. V., Pt. I., Lamell. II., p. 315. Pl. XLV., Figs 6, 10, 16, 23, 26, 27; Pl. XCIII., Figs. 1, 3.

Observations.—In the general shape of the valves and their surface ornamentation our Victorian variety agrees fairly closely with the form figured by J. Hall under the names of *Cucullæa opima* and *Nucula randalli.* Hall remarked on the identity of the fossils described under the two above-named species,* but preferred to retain the later name since it had "gone into the literature of the science." The earlier name, however, should undoubtedly be employed, in accordance with accepted rules of nomenclature. The N. American examples were obtained from the Hamilton Group of the State of New York.

The Victorian specimens are much smaller than the N. American, the largest measuring only 13 mm., whilst the average length of J. Hall's examples is about 23 mm. In the Victorian variety there is a greater tendency for the concentric striæ to become fasciculate. Two of our specimens (Pl. III., Figs. 41, 43) show a remarkable gibbosity of the umbonal area.

Horizon and Locality.—Silurian (Melbournian). From the Yarra Improvement works, S. Yarra, presented by Mr. F. P. Spry; also from the coll. Geol. Survey of Victoria, north of Yan Yean, B$^{b.}$ 11; from a shaft of the tunnel in Reservoir, Yan Yean, B$^{b.}$13; Fraser's, or No. 3, Creek, Springfield, B$^{b.}$ 25. Silurian (Yeringian). About 1½ miles below Simmons' Bridge Hut, on the Yarra; coll. Geol. Surv., Vict., B16. [7909 (type), 7910-13, 965-6.]

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* Op. supra. cit., 1885, p. 315, footnote.

Nucula cf. *lirata*, Conrad sp. Pl. III., Fig. 44.

Nuculites lirata, Conrad, 1842, Journ. Acad. Nat. Sci., Philad., Vol. VIII., p. 250, Pl. 15, Fig. 7.

Nucula lirata, Conrad, sp., J. Hall, 1885, Pal. N. York, Vol. V., Pt. I., Lamell. II., p. 316, Pl. XLV., Figs. 5, 11, 15, 17-22, 24, 25; Pl. XCIII., Fig. 5.

Observations.—Our figured specimen is a crushed valve of a *Nucula*, showing the ligament-pit and denticulate cardinal area. The strong liræ and the general form of the shell, point to an affinity with the above species, which occurs in the Hamilton Group of N. America.

Horizon and Locality.—Silurian (Melbournian). From the coll. of Geol. Surv. of Vict., Yan Yean, Bb. 14. [7914.]

Nucula lamellata, J. Hall. Pl. III., Figs. 45 (var.), 46.

Nucula lamellata, J. Hall, 1885, Pal. N. York, Vol. V., Pt. I., Lamell. II., p. 320, Pl. XLV., Fig. 13; Pl. LI., Figs. 18-21; Pl. XCIII., Fig. 7.

Observations.—This species of *Nucula* is of a somewhat different type to the usual forms, particularly in the sub-quadrate outline, and the sub-central position of the beaks. A connecting link between the sub-ovate forms and this species is exemplified in *N. lirata*, Conrad, sp.*

In nearly all the Victorian specimens before us, represented either as internal impressions or hollow casts, the ligament pit is visible. One of our fossils (Fig. 45) appears to be a short variety of the above species. The specimens referred to by McCoy on quarter sheet 4 S.W., Geol. Surv. Vict. (notes on Bb. 18, 20, and 22), under the MS. name of *Orthonotus subrigidus* are here included under *Nucula lamellata*, J. Hall.

In N. America, *N. lamellata* is found in the Hamilton and Chemung Groups in the State of New York.

Horizon and Locality.—Silurian (Melbournian). Schist Hill, Merri Creek, coll. Geol. Surv. Vict., $B^{b.}$ 6; south end of Reservoir, Yan Yean, coll. Geol. Surv. Vict., $B^{b.}$ 14; Broadhurst's Creek, east of Kilmore, coll. Geol. Surv. Vict., $B^{b.}$ 18 (short variety); Kilmore creek, north of Special Survey, coll. Geol. Surv. Vict., $B^{b.}$ 20; Police Paddock, Kilmore, coll. Geol. Surv. Vict., $B^{b.}$ 22. Silurian (Yeringian); about 1½ miles below Simmons' Bridge Hut, on the Yarra, coll. Geol. Surv. Vict., B16. [2252, 2243-49.]

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* See above references.

Family **Ledidæ**.

Genus Palæoneilo, J. Hall, 1870.

Palæoneilo victoriæ, sp. nov. Pl. III., Figs. 47-49.

Description.—Shell of variable size, length more than twice the height, rostrate; moderately convex in the umbonal region and the triangular area beneath, the latter bounded by the anterior slope and the posterior umbonal ridge. Cardinal line nearly straight or only slightly arcuate; ventral border sub-parallel and straight, but narrowing the shell posteriorly, widely rounded anteriorly to meet the cardinal line at an obtuse angle; the hind extremity narrow, with the postero-ventral angle bluntly rounded, curving backward and inward to the cardinal line, which posteriorly forms a salient angle. Escutcheon well marked, the depressed area bounded abruptly by the umbonal ridge. Surface of shell gently convex and sloping anteriorly; towards the ventral margin the surface slopes more steeply, whilst the margin itself, in adult shells, is depressed and flange-like. Beaks sub-central or slightly posterior, prominent, somewhat incurved and depressed, or only moderately inflated. Hinge showing an alternating series of curved bars and sockets. On the cardinal border there is a well-marked groove to receive the external ligament. Surface ornamented with numerous concentric lamellar ridges, between which are several parallel thread-like striæ, whilst, in a very few well-preserved examples, traces of fine lineations radiating from the umbo are seen, especially stronger on the salient edges of the concentric lamellæ.

Measurements.—Type specimen (Pl. III., Fig. 47). Length, 27 mm.; height, 12 mm.; number of concentric lamellæ in the space of 4 mm., measured in median area—7.

A medium-sized example.—Length, 17 mm.; height 7.5 mm.; number of concentric lamellæ in the space of 4 mm. in the median area—9.

A small example.—Length, 13 mm.; height, 6 mm.; number of concentric lamellæ in space of 4 mm.—16.

Observations.—The number of the concentric lamellar ridges to a given width is not a factor of any importance in dealing with this group, so far as the Victorian examples show, and the various graduations in ornament do not allow of even a sub-varietal division of the species. A possible explanation of this varying feature in ornamentation, and one partly borne out by the evidence before us is, that in areas of quiet sedimentation the molluscs found time and material for forming a broad varix along the pallial border; whereas in sandy areas or under impure conditions of the water, as, for instance, in the presence of decaying crustacea and cephalopoda, seen in the Domain-road examples, the successive laminæ were laid down closer together, and the shell itself would be proportionately thin and depauperated.

This, together with another newly-described ornate species, *P. producta*, are among the commonest forms of the genus in the Victorian rocks.

Affinities.—*P. victoriæ* somewhat resembles the type of shell described under the name of *P. muta* by J. Hall,* from the Hamilton Group of the State of N. York. *P. muta* differs, however, from our species in having the beaks decidedly anterior, in the extremely lamellose condition of the main concentric striæ, and in the absence of the concavely depressed escutcheon in the posterior region.

Horizon and Locality.—Silurian (Melbournian). From the Yarra Improvement Works, S. Yarra, in blue and yellow shale, common; in the hard, dark shale of the Domain-road Sewerage Works at 103 ft. from surface, presented by Mr. F. P. Spry. In the yellowish sandstone with casts of shells, coll. Geol. Surv. Vict., Moonee Ponds Creek, Flemington; in the brown argillaceous rock of Broadhurst's Creek, east of Kilmore, coll. Geol. Surv. Vict., B$^{b.}$ 18. In the brown argillaceous sandstone of Anderson's Creek, near Warrandyte, coll. Geol. Surv. Vict., B22; in the sandstone of Fraser's, or No. 3, Creek, Springfield, coll. Geol. Surv. Vict., B$^{b.}$ 25. [7915 (type), 7916-7.]

Palæoneilo raricostæ, sp. nov. Pl. III., Fig. 50.

Description.—Shell of variable size, length more than twice the height, elongate-ovate, rostrate. Depressed convex. Umbonal ridge not strongly developed. Anteriorly broad and well-rounded, the margin meeting the cardinal line at an obtuse angle; posteriorly produced and sharply rounded. Cardinal line arcuate, straight between the vertical line and the posterior angle. Beaks depressed. Teeth of hinge characteristic, but comparatively large and few. Greatest convexity of shell-surface just behind the anterior umbonal slope. Shell ornamented with well-marked lamelliform concentric varices, comparatively widely spaced, the area between each being relieved by numerous thread-like striæ.

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* Palæont. N. York, Vol. V., Pt. I., 1885, Lamell. II. p. 337, Pl. XLIX., Figs. 25-32.

Measurements.—Type specimen : Length, 21.5 mm.; height, 9 mm.; number of concentric lamellar ridges measured over a width of 4 mm.—5.

Observations.—The above species is recognised by its depressed valves, the somewhat acutely rostrate posterior extremity, and the comparatively wide interspace between the concentric ridges.

Affinities.—This species also shows certain affinities with the previously-mentioned *P. muta,* J. Hall, from the Hamilton Group of New York State. The rostrate extremity of *P. raricostæ* and its depressed shape shows it to be specifically distinct.

Horizon and Locality.—Silurian (Yeringian). From the dark mudstone at the junction of the Woori Yallock and the Yarra, coll. Geol. Surv. Vict., B23. In the olive-brown mudstone about 1½ miles below Simmons' Bridge Hut on the Yarra, coll. Geol. Surv. Vict., B16. [7918 (type), 2251.]

Palæoneilo spectabilis, sp. nov. Pl. III., Figs. 51, 52.

Description.—Shell of medium size, elongate ovate, rostrate; strongly convex in the umbonal region. Beaks nearly central, moderately well-inflated and gibbous. Cardinal line arcuate, gently curving to the broad anterior extremity. Ventral border straight, inclining posteriorly towards the cardinal line, and meeting the latter in a somewhat sharp curve. Umbonal slope forming with the median area a sinuous and obtuse ridge. Anterior slope gently convex. Teeth comparatively stout, and not so numerous as usual in this genus; about 10 on the posterior side of the beak. Surface having a series of concentric step-like folds and lamellar ridges, with comparatively fine striæ in the intervals between the ridges.

Measurements.—The type specimen: Length, 28.5 mm.; height, 11.5 mm.; depth of valve, about 4 mm.

Observations.—This species is distinguished from *P. victoriæ* by its umbonal convexity and conspicuously rostrate outline. It is also a much heavier shell, and the groove for the external ligament is more distinctly seen.

Horizon and Locality.—Silurian (Melbournian). In the blue and yellow shale of the Yarra Improvement Works, S. Yarra. Type presented by Mr. F. P. Spry. Also in the fine-grained sandstone at Moonee Ponds Creek, Flemington, coll. Geol. Surv. Vict., B 8. [7919 (type), 7920.]

Palæoneilo producta, sp. nov. Pl. III., Figs. 53, 53*a*.

Description.—Shell small, ovate, very long, length more than twice the height; posteriorly attenuate, almost rostrate. Cardinal line only slightly arched, ventral border gently rounded, and curving upward toward the posterior end, then abruptly forward, meeting the cardinal line at an obtuse angle; well-rounded anteriorly, and curving boldly to the cardinal line. Beaks acuminate and salient, nearly central. Valves depressed-convex below; highest in the middle and at the umbonal region, sloping steeply towards the front, and gently to the posterior extremity, except where interrupted by the umbonal ridge and sulcus; the latter is rather feebly developed, and is parallel with, and in front of, the posterior umbonal ridge. Shell surface marked with very fine, regularly concentric striæ, about 12 to the millimetre, counted on the middle of the shell below the umbonal inflation.

Measurements.—Type specimen: Length, 15 mm.; height, 6.75 mm.; depth of valve, about 2.5 mm.

The average length of the larger number of specimens found is 11 mm.

Affinities.—This species shows a certain relationship to ***Palæoneilo elongata***, J. Hall,* from the Chemung Group (Upper Devonian) of the States of New York and Pennsylvania. The points of difference, however, are these:—

The present species has more acuminate beaks.

It is proportionately more elongate.

The cardinal margin is less arcuate.

The surface striæ are finer and more than twice as numerous.

Horizon and Locality.—Silurian (Melbournian). Common in the blue and brown shale at the Yarra Improvement Works, S. Yarra (type specimen presented by Mr. F. P. Spry). Also from the Domain-road sewer, S. Yarra. In the coll. Geol. Surv. Vict. a single specimen from N. of Yan Yean, $B^{b.}$ 11. [7921 (type), 7922, 1563.]

Palæoneilo ? constricta, Conrad sp. Pl. III., Fig. 54.

Nuculites constricta. Conrad. 1842. Journ. Acad. Nat. Sci., Philad., Vol. VIII., p. 249, Pl. XV., Fig. 8.

Palæoneilo constricta, Conrad sp., J. Hall, 1885, Pal. N. York, Vol. V., Pt. I., Lamell. II., p. 333, Pl. XLVIII., Figs. 1-16; Pl. LI., Fig. 17.

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* Palæont. N. York, Vol. V., Pt. I., 1885, Lamell. II., p. 345, Pl. XLVIII., Fig. 39; Pl. XCIII., Fig. 11*a*.

Observations.—Our figure is drawn from a cast of a nuculoid shell which, by its depressed umbo, apparent absence of a ligament-pit and constricted posterior angle, falls into the genus *Palæoneilo* as defined by J. Hall. The present specimen is exactly comparable in outline with Conrad's figure of *P. constricta,* and it further shows a characteristically large posterior adductor impression. In the absence of external ornament there is some slight doubt as to its specific identity.

This species ranges through the Devonian of North America.

Horizon and Locality.—Silurian (Melbournian). In the shale of the Yarra Improvement Works, S. Yarra. [7923.]

Palæoneilo cf. *brevis,* J. Hall, P. VI., Fig. 55.

Palæoneilo brevis, J. Hall, 1870, Prelim. Notice Lamell. 2, p. 10, Id. 1885, Pal. N. York, Vol. V., Pt. I. Lamell. II. p. 342, Pl. L., Figs. 24-33.

Observations.—Our specimen is comparable with the above form in having a short, ovate valve, ornamented with fine concentric striæ. The posterior margin is not perfect, but the depressed surface in front of the umbonal ridge is sufficient indication of the presence of a constriction on the basal margin of the shell. In the absence of more perfect specimens it will be safer to indicate the species with some reserve. J. Hall's examples were from the Chemung Group (Up. Devonian) of the States of New York and Pennsylvania.

Horizon and Locality.—Silurian (Melbournian). In pale mudstone, Merri Creek, sects. 2 and 3, Kalkallo (Kinlochewe), coll. Geol. Surv. Vict. B^b3. [968.]

Palæoneilo cf. *tenuistriata,* J. Hall, Pl. III., Fig. 56.

Palæoneilo tenuistriata, J. Hall, 1885, Pal. N. York, Vol. V., Pt. I. Lamell. II., p. 336, Pl. XLIX., Figs. 1-12, 14; Pl. XCIII., Fig. 13.

Observations.—Our figure is taken from a wax squeeze of a mould of the external surface of shell. In the regularly and finely striate surface, and the obovate form of the valve it can be closely compared with J. Hall's species cited above. The strongest points of difference are, the obsolescence of the postero-umbonal sulcus in our form, and the central position of the beaks, although one example figured by Hall approaches ours very closely in this respect. The Victorian specimen may also be compared with *P. fecunda*, J. Hall,* although that species has a marked depression in front of the umbonal ridge.

P. tenuistriata occurs in the Hamilton Group in the States of New York and Pennsylvania.

Horizon and Locality.—Silurian (Melbournian). In the whitish mudstone of Merri Creek, Sects. 2 and 3, Kalkallo, coll. Geol. Surv. Vict. B^b 3. [967.]

Family **Parallelodontidæ.**

Genus PARALLELODON, Meek and Worthen, 1866.

Parallelodon spryi, sp. nov. Plate I., Fig. 3.

Description.—Shell of medium size, subovate; cardinal line nearly straight, meeting the posterior border almost at right angles, but slightly upturned; ventral border convex, narrower anteriorly, and broadly curved posteriorly. Median area swollen, rising prominently towards the beaks, which are situated sub-anteriorly; posterior region compressed. Cardinal area exposed in the type specimen, showing what appears to be the extremity of a series of about six parallel and slightly oblique hinge-teeth. Surface of valves grooved concentrically, the highest part of the ridges being obliquely striated, the striæ radiating from the beaks. Indications present of a large anterior muscle impression situated close to the cardinal area.

Measurements.—Length, about 26 mm.; height, 17 mm.; thickness of entire shell, 8 mm.

Observations.—The presence of a parallel series of anterior teeth points to relationship with *Parallelodon, sensu stricto*. The genus *Macrodon*, Lycett, 1845 (nom. emend. *Macrodus*, Beushausen, 1895)† is closely allied, and is regarded by Dall‡ as synonymous. The latter genus differs in some slight respects, such as the obliquity of the anterior teeth. Should both types prove to be congeneric, the former name will stand, since the latter had been used by J. Müller for a genus of fishes, whilst Beushausen's name is of much more recent date.

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*Tom. supra cit., p. 336, Pl. XLIX., Figs. 13, 15-24.

† Abhandl. von Preuss. Geol. Landesanst., N. F. Heft. XVII. p. 36.

‡ Text-book of Palæontology, Zittel-Eastman, 1900, p. 364.

Affinities.—Both *Macrodon hamiltoniæ*, J. Hall, of the Hamilton Group of N. America* and *Macrodus villmarensis*, Beushausen, from the upper beds of the Middle Devonian of the Rhine area† bear a general resemblance to our species, but in many points of detail they are quite distinct, lacking the boldly curving ventral margin, and strong compression of the posterior region of the shell seen in the Australian species.

Horizon and Locality.—Silurian (Yeringian), Wandong, Victoria; in yellow sandstone. Type specimen collected and presented by Mr. F. P. Spry, after whom the species is named. [7950.]

Parallelodon æqualis, sp. nov. Plate IV., Fig. 57.

Description.—Shell small, elongate oval, rounded and constricted in front, broader and truncated behind, with a sharp umbonal ridge extending from the umbo to the postero-ventral margin. Beaks sub-anterior, or nearly central, inflated and directed forward. Cardinal line straight; ventral border slightly curved and approximately parallel with the hinge-line. Three posterior, oblique, lateral teeth visible behind the beaks, and close to the cardinal border.

Measurements.—Length, 12 mm.; height, 7.5 mm.; depth of valve, 2.5 mm.

Observations.—The above species belongs to a type of shell of which the "*Arca scitula*" of McCoy‡ is an example. That species differs from ours in the more extended posterior, and in the strong concentric surface ornament; McCoy's species may, however, eventually prove to be more nearly related to the North American Devonian types of this genus.

Horizon and Locality.—Silurian (Melbournian). In brown mudstone, Yarra Improvement Works, S. Yarra. Presented by Mr. F. P. Spry. [7924.]

? Parallelodon kilmoriensis, sp. nov. Pl. IV., Fig. 58, ? fig. 59.

Description.—Shell small, rhomboid, sub-circular; length a little more than the height. Ventral margin boldly rounded; both extremities broad, the anterior short and truncate, the posterior margin curving upward and forward to meet the cardinal line. Beaks prominent, slightly anterior, pointing forward and inward, umbonal area triangular, with a slight vertical depression from the beak towards the ventral margin. Cardinal line long and straight; cardinal area compressed in front and behind. Surface marked with fine concentric lines of growth, which become lamellose in the cardinal area.

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* Prelim. Notice, Lamelli., 2, p. 13, 1870. See also J. Hall, Palæont. New York, Vol. V., Pt. I. Lamellibranchiata, II., 1885, p. 349, Pl. LI., Figs. 1, 7, 9, 10.

† Abhandl. von. Preuss. Landesanst., N. F. Heft., XVII., 1895, p. 38, Pl. IV., Fig. 2.

‡ Synopsis of the Silurian Fossils of Ireland, 1846, p. 20, Pl. II., Fig. 6.

Measurements.—Length, 16 mm.; height, 14 mm.; depth of valve, 3.5 mm.

Observations.—This species is referred to the genus *Parallelodon* with some reservation, since the hinge structure is obscure. The evidence tends, however, in the direction of this genus, for the beaks are not closely adpressed, and the cardinal area is lamellose, as in typical forms of *Parallelodon*, pointing to the former presence of an external and amphidetic ligament.

The specimen figured on Pl. VI., Fig. 4, although at first suggestive of *Tellinopsis*, is apparently referable to this species, possessing the lamellose cardinal area and traces of teeth.

Horizon and Locality.—Silurian (Melbournian). Coll. of the Geol. Surv. Vict. in the Nat. Museum; Police paddock, Kilmore, B$^{b.}$ 22. Also a doubtful example from Swanston-street sewer, Melbourne. [7925 (type), 7926.]

Family **Pterineidæ.**

Genus Pterinea, Goldfuss, 1832.

Pterinea lineata, Goldfuss. Pl. IV., Fig. 60.

Pterinea lineata, Goldfuss, 1837, Petrefactiæ Germaniæ, Vol. II., p. 135, Pl. CXIX., Figs. 6 *a-c*.

cf. *Ambonychia tatei*, Cresswell, 1893, Proc. Roy. Soc. Vict., Vol. V., N.S., p. 44, Pl. IX., Fig. 8.

Observations.—There is very little doubt that the imperfect valve figured under the name of *Ambonychia tatei* by the Rev. A. W. Cresswell is an example of *Pterinea lineata*, Goldfuss. Fragments of the above form are fairly common at some Yeringian localities east of Melbourne, and it seems to be a characteristic form in the uppermost Silurian beds in Victoria.

In Britain, this species was recorded by McCoy from the Ludlow beds; in Germany it is a well-known Devonian fossil.

Horizon and Locality.—Silurian (Yeringian). ? Lilydale (Rev. A. W. Cresswell); north of Lilydale, in mudstone, presented by the Rev. A. W. Cresswell; and Croydon, near Lilydale, in mudstone, presented by Mr. Thos. Warr. [7927, 2269 (type of "A. tatei")].

? *Pterinea tenuistriata*, McCoy. Pl. IV., Fig 61.

Pterinea tenuistriata, McCoy, 1852, Brit. Pal. Foss., p. 263, Pl. 1 I., Fig. 4.

Observations.—The Victorian example shows very little difference from McCoy's figured specimen; the chief distinction being the acute form of the ears, a character which is not sufficiently important to justify its separation from the British species. Were there other specimens for comparison it is probable that we should find more typical examples amongst them. The general form and surface ornament is similar to the British species. It has been recorded in Britain from the Wenlock and the Lower and Upper Ludlows. This species is doubtfully referred to the genus *Pterinea*, as further examples may show that both McCoy's and our specimens are really referable to *Actinopteria.*

Horizon and Locality.—Silurian (Melbournian). Yarra Improvement Works, S. Yarra. Presented by Mr. F. P. Spry. [7928-29.]

Genus Actinodesma, Sandberger, 1850.

Actinodesma cf. *ampliata*, Phillips, sp. Plate VI., Fig. 87.

Avicula ampliata, Phillips, 1848, Mem. Geol. Surv. Gt. Brit., Vol. 2, Pt. 1, p. 367, Pl. XXIII., Fig. 1.

Pterinea ampliata, Phillips, sp., de Koninck, 1876, Foss. Pal. Nouv.-Galles du Sud, Pt. 1, p. 37.

Observations.—A somewhat imperfect valve of a *Pterinea*-like shell which occurs in the present series is, with very little doubt, referable to the above genus. It is most closely allied to Phillips' species above-mentioned, both in form and ornament, which fossil was originally described from the Upper Ludlow of Llangadoc in Wales.

De Koninck has recorded this species from Silurian rocks at Dangelong, Cooma District, New South Wales.

Comparison may also be made with J. Hall's "*Glyptodesma*" *erectum,** from the Hamilton Group of N. America. This shell, however, is longer on the ventral margin, and the valve is not so strongly convex.

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* Pal. N. York, Vol. V., Pt. I., 1884, Lamell., I., p. 153, Pl. XI., Figs. 1-10; Pl. XII., Figs. 1-3, 5-9; Pl. XIII., Figs. 1-4, 12-15; Pl. XXV., Figs. 14-17; Pl. LXXXVI., Figs. 1-8; Pl. LXXXVII., Figs. 1-3.

Our fossil, which is the impression of the interior of a left valve, shows the presence of transverse striæ on the cardinal line.

Horizon and Locality.—Silurian (Yeringian). North of Lilydale; presented by the Rev. A. W. Cresswell, M.A. [2267.]

Family **Lunulicardiidæ.**

Genus LUNULICARDIUM, Münster, 1840.

Lunulicardium antistriatum, sp. nov. Pl. V., Figs. 62, 63, 63*a*-64, 65 (juv.).

Description.—Shell vertically sub-elliptical to sub-circular, somewhat oblique; generally highly convex. Beaks prominent, sub-anterior, incurved, with an external ligamental groove situated in front of the beak. Anterior border narrow; posterior broad, gently curved and sub-truncate. Surface marked concentrically with coarse rugæ, and radially striated, bearing numerous fine riblets, sometimes showing a granulose ornamentation when magnified.

Measurements.—A typical left valve. Height, 36 mm.; length, 30 mm.; depth of valve, 7 mm. Right valve of a long variety—height, 18 mm.; length, 21 mm.; depth of valve 6 mm.

Observations.—The above fossils, from the uppermost beds of the Victorian Silurian, at first glance present little difference from those figured under the name of ? *Cardium striatum* by Sowerby.* A minute inspection of a fairly long series of Australian specimens shows, however, that, although closely related to Sowerby's species, their costulæ are less numerous and more distinctly medially grooved, especially towards the ventral margin of the shell, and also that the concentric folds are much more pronounced. Our species is more oblique than that figured by Sowerby, and in this respect they agree more closely with the variety mentioned by that author, from Brindgwood Chace (loc. cit., p. 614). A specimen of the Dudley shell in the National Museum collection shows the multistriate character of the external surface very clearly, and that the riblets or striæ tend to become medially grooved near the ventral margin. The related British species ranges from the Bala beds to the Lower Ludlow.

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* In Murchison's Silurian System, 1839, Pt. II., p. 614, Pl. VI., Fig. 2. *Cardiola striata*, Sow. sp., Etheridge, 1888, Foss. Brit. Ids., Vol. I., Palæozoic, p. 102.

From the Tentaculite slates (G^2) of Bohemia, Barrande has described *Lunulicardium granulosum*, which, although a more depressed shell, is closely related to our species, more especially in the granulose ornament of the shell surface.*

In the shaly mudstone from the mouth of Starvation Creek there also occur numerous small bivalves (Figs. 64, 65), which, on first examination, might reasonably be mistaken for a species of *Vlasta;* in its superficial character and general form, however, it corresponds very closely to the prodissoconch and early dissoconch stages of *Lunulicardium antistriatum.* In connexion with these specimens it is interesting to compare the figure of *? Vlasta*, sp., figured by Mr. F. R. C. Reed from the Upper Silurian beds of Zebingyi, Burma.†

Horizon and Locality.—Silurian (Yeringian). Common in the blue slates and shales of McMahon's Creek, Upper Yarra, Dept. of Mines coll. (3778); Reefton, near Warburton, Dept. of Mines coll. (3432, 3434).‡

The apparently young examples, or micromorphs of the present species occur at Mount Matlock, associated with *Tentaculites matlockiensis*, Chapm., specimens presented to the Museum by N. Lepoidivil, Esq., in 1877; and from the mouth of Starvation Creek, coll. Dept. Mines, Vict. (3368).§ [2257 (type), 2255, 2260-61.]

Family **Ambonychiidæ.**

Genus AMBONYCHIA, J. Hall, 1847.

Ambonychia acuticostata, McCoy, Pl. IV., Fig. 66.

? Ambonychia acuticostata, McCoy, 1852, Brit. Pal. Foss., p. 264, Pl. 1K., Figs. 16, 16*a*.

Observations.—This is a sub-trigonal or sub-ovate shell, which in its general form and ornamentation closely resembles McCoy's species from the Wenlock and Lower Ludlow Beds of Wales. Our specimen shows a less distinct costation on the umbonal part of the shell, but this may be due to imperfect preservation, as it seems to have been partly decorticated. The tegulate ornament on the sharp costæ towards the base of the shell appears exactly as shown in McCoy's drawing. There seems to be no reason for doubting the generic affinity of this species, although queried by McCoy. In his Fossils of the British Islands, Robt. Etheridge refers* to the genus without a query, but misquotes the specific name as "acuticosta."

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* Syst. Sil. Bohem., Vol. VI., Pt. I., Pl. 192, Figs. 6-10.

† Palæontologia Indica, N.S., Vol. II., Mem. 3, 1906, p. 119, Pl. VI., f. 37.

‡ See Prog. Rep. No. IV., 1877, Geol. Surv. Vict., pp. 156, 157, where the late Sir F. McCoy indicated their age to be Upper Silurian (Ludlow).

§ See tom. supra cit., p. 156, where McCoy refers to these specimens as "a small *Aviculoid* shell allied to *Ambonychia* (new species)."

Horizon and Locality.—Silurian (Yeringian). Cave Hill, Lilydale. Collected by the author. [2268.]

Genus MYTILARCA, J. Hall, 1873.

Mytilarca acutirostris, sp. nov. Pl. IV., Fig. 67.

Description.—(Cast). Small, ovate, sub-trigonal; length slightly less than the height. Anterior and basal margins curved and meeting almost at right angles; posterior margin truncate and broadly curved. Beaks acuminate, curving sharply forward. Cardinal grooves present on the anterior and posterior ligamental areas. An anterior umbonal ridge passing immediately below the beaks to the ventral margin. Highest part of valve just behind this ridge. Surface of shell gently curving from the beaks to the base and truncated posterior margin, steeply falling to the anterior border, where it is depressed, and continued so along the base. Inner surface markings consisting of numerous, indistinct, concentric growth lines seen as shallow sulci.

Measurements.—Length, 9 mm.; height, 10.5 mm.

Affinities.—The present species differs from *Mytilarca* [" *Cardium* "] *trigona*, Goldfuss sp.† in having the beaks more incurved, and a more rounded basal margin. Another species which seems to bear some relation towards ours is Salter's *Mytilarca* [" *Mytilus* "] *chemungensis* (*non* Conrad), from the Wenlock Shale of Usk, Wales.‡ This is, however, a more generally elongate form.

Horizon and Locality.—Silurian (Yeringian). Coll. Geol. Surv. Vict., from junction of the Woori Yallock and Yarra, B 23. [7930.]

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* Vol. I., 1888, p. 99.

† Petrefactiæ Germaniæ, Vol. II., 1837, p. 215, Pl. CXLII., Figs. 8a-c.

‡ Mem. Geol. Surv. Gr. Brit., Vol. II., Pt. I., 1848, p. 365, Pl. XX., Figs. 10, 11.

Family **Conocardiidæ.**

Genus CONOCARDIUM, Brown, 1835.

Conocardium bellulum, Cresswell, sp.

Pleurorhynchus bellulus, Cresswell, 1893, Proc. Roy. Soc. Vict., Vol. V., N.S. p. 43, Pl. IX., Fig. 6.

Observations.—This species is distinguished from the rarer form which accompanies it, by the more numerous costæ, which are typically lamellated or even squamose, by the greater obliquity of the umbonal ridge, and by its generally smaller size.

Affinities.—The nearest described form to *C. bellulum* is Salter's species *C. dipterum** from the Upper Ordovician (Bala beds) of Ayrshire, Scotland. In this species, however, the umbonal ridge and the costæ are not so oblique nor so strongly curved.

C. bellulum also shows some alliance with *Conocardium cuneus*, Conrad sp. var. *nasuta*, J. Hall,† a fossil which occurs in the Helderberg series of New York State.

Horizon and Locality.—Silurian (Yeringian). The type specimen was found by the Rev. A. W. Cresswell at Cave Hill, Lilydale. It is also an abundant species in the dark-blue limestone of Deep Creek, a tributary of the Thomson River, Gippsland, 7 miles N. of Walhalla. Specimens from the latter locality were presented to the National Museum by Mr. Cresswell. In the Geol. Surv. Coll. from the junction of the Woori Yallock and Yarra, B 23, we have a single specimen in mudstone, which is also referable to the above species. [911 (type), 2343-51, 7932.]

Conocardium costatum, Cresswell sp.

Pleurorhynchus costatus, Cresswell, 1893, Proc. R. Soc., Vic., Vol. V. N.S., p. 43, Pl. IX., Fig. 5.

Horizon and Locality.—Silurian (Melbournian); a slightly crushed and otherwise imperfect specimen from the Domain-road sewer is here doubtfully referred to the above species.—Presented by Mr. F. P. Spry.

Silurian (Yeringian). The type specimen came from Cave Hill, Lilydale, and there is also another specimen from the same locality in the National Museum collection. [910 (type), 1086, 7931.]

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* In Murchison's Siluria, 1859, 3rd ed., p. 214, Fossils 36, Fig. 7 (*Pleurorhynchus dipterus*).

† Pal. N. York, Vol. V., Pt. I., 1885, Lamell, II., p. 410, Pl. LXVII., Figs. 12-20.

Family **Pteriidæ.**

Genus Actinopteria, J. Hall, 1883.

Actinopteria texturata, Phillips sp., Plate IV., Figs. 68, 68a.

Avicula texturata, Phillips, 1841, Palæozoic Fossils of Cornwall, W. Devon and Somerset, p. 51, Pl. XXIII., Figs. 87*a*, *b*.

Pterinæa texturata, Phill. sp., R. Etheridge, 1888, Foss. Brit. Islands, Vol. I., p. 159.

Actinopteria texturata, Phill. sp., Whidborne, 1892, Devonian Fauna (Pal. Soc. Mon.), p. 74, Pl. IX., Figs. 2, 2a, 3, 3a, 5-7.

Observations.—This is an oblique shell with an unusually deep left valve. The ornament is very distinct from the usual type in this genus, consisting of a series of rounded radial riblets crossed at varying intervals by moderately thin undulating laminæ, and this gives to the shell-surface a woven appearance. The only difference between our form and already described specimens is the convexity of the posterior wing of the left valve, which, however, seems to be a minor character. An extraordinarily large specimen, which may belong to this species, occurs in the present series; this specimen shows a tendency in the gerontic stage to throw off irregular concentric laminæ on the shell-surface, instead of regular, rounded threads, whilst the radii become almost obsolete towards the ventral margin.

The previously-recorded examples of *Actinopteria texturata* were from the Devonian, of Devonshire, England; the occurrence of Victorian specimens thus extends its range both from a geographical and geological point of view.

This figured specimen is probably that referred to by Mr. Cresswell as "*Pterinæa sub-falcata*, or an allied species."* It differs from Conrad's *sub-falcata* in the character of the ribs, which in that species are not crossed by intermediate threads.

Measurements.—Spec. *a* (figured).—

Height, 23 mm.; length, 19 mm.; depth of valve, 5 mm. Spec. *b* (? *texturata*)—

Height, about 53 mm.; length, about 46 mm.; depth of valve, about 16 mm.

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* Proc R. Soc., Vict., Vol. VI., N.S., 1894, p. 156.

Horizon and Locality.—Silurian (Yeringian). The figured specimen is from the mudstone N. of Lilydale; the large example is from the limestone of Cave Hill, Lilydale. Both specimens were collected by the Rev. A. W. Cresswell, M.A. [2264, 2270.]

Actinopteria boydi, Conrad sp., Plate IV., Fig. 69, Pl. V., 70.

Avicula boydii, Conrad, 1842, Journ. Acad. Nat. Sci., Philad., Vol. VIII., p. 237, Pl. XII., Fig. 4.

Pterinea boydi, Conrad sp., McCoy, 1852, Brit. Pal. Foss., p. 259.

Actinopteria boydi, Conrad sp., J. Hall, 1884, Pal., N. York, Vol. V., Pt. I., Lamell. I., p. 113, Pl. XIX., Figs. 2-24; Pl. LXXXIV., Figs. 16, 17.

Observations.—This very handsome species, although variable, is sufficiently distinguished by its characteristic radial and concentric ornament; the concentric laminæ are undulose and concave between the rays, meeting the latter in a more or less sharp point. The edges of the concentric lamellæ are often so pronounced as to give rise to a series of scalloped frills. The areas cut off by the concentric lamellæ are usually much higher than broad.

This species occurs in the Upper Ludlow in Britain, at Kendal, in Westmoreland. In N. America it is abundant in the shales of the Hamilton Group in New York State.

Horizon and Locality.—Silurian (Yeringian). In mudstone from Wilson's, near Lilydale, presented by Mr. J. T. Jutson. Also from a shallow well at Croydon, presented by Mr. Thos. Warr. [7933-35.]

Actinopteria asperula, McCoy sp., var. *croydonensis,* nov., Plate V., Fig. 71.

Observations.—This variety is distinguished from the type species described by McCoy,[*] by its shorter form and fewer ribs, the latter numbering about 22 on the body of the shell in the Victorian variety. The essential characters of our shell, so far as they can be made out, are, with the above exceptions, the same as those of the specific form. McCoy's species was recorded from the Caradoc series of Radnorshire, Wales.

Horizon and Locality.—Silurian (Yeringian). In the yellow mudstone from a shallow well near Kilsyth Post Office, Croydon, near Lilydale. Presented by Mr. Thos. Warr. [7936.]

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[*] *Pterinea? asperula,* Ann. Mag. Nat. Hist., 2nd ser., Vol. VII., 1851, p. 60. Brit. Pal. Foss., Pt. II., 1852, p. 259. Pl. II., Fig 5.

Actinopteria cf. *sowerbii*, McCoy, sp. Pl. V., Fig. 72.

Avicula reticulata, Sowerby (*non* Hisinger, *non* Goldfuss), 1839, in Murchison's Silurian System, p. 614, Pl. VI., Fig. 3.

Pterinea sowerbii, McCoy, 1852, Brit. Pal. Foss, p. 263.

Observations.—The Victorian specimen is represented by an imperfect mould of the shell, and a wax impression of this shows it to be closely allied to the above-named species. The ornament of lamellated concentric folds, and the interrupted radii, together help to support this identification. Until better specimens have been discovered, however, it is safer merely to point out its relationship with the British fossil, which has been recorded as ranging from the Upper Llandovery to the Aymestry Limestone.

There is another species to which our shell bears some resemblance, namely, "*Pterinea*" *lamellosa*, Goldfuss,* but the radial ornament of the latter is much more strongly pronounced than in our specimen. Goldfuss' species is a typically Devonian shell, and has only been doubtfully recorded from the Wenlock shale and limestone in Britain.†

Horizon and Locality.—Silurian (Yeringian). Reefton, Warburton, Upper Yarra; coll. Geol. Surv. Vict. (spec. 3431). [7937.]

Actinopteria heathcotiensis, sp. nov. Pl. V., Fig. 73.

Description.—Left valve obliquely extended to the posterior angle; umbo sub-anterior, rather prominent. Anterior ala (?) small, posterior triangular, inflated in the central area; the longest side adjoining the posterior slope and extending half-way down the posterior margin. Anterior extremity narrow, the border curving obliquely round the ventral to the posterior margin, which is greatly produced, meeting the border of the posterior slope at a blunt angle. Posterior slope distinctly hollowed. Surface of shell evenly and gently convex from the middle of the umbonal area to the posterior corner, and more strongly convex from the umbo to the ventral margin. The shell is concentrically sulcose and striated, the striæ turning up at an acute angle on the posterior wing. Traces of radial striæ from the umbo to the ventral border. A salient feature of this species is the strongly convex ventral margin.

Measurements.—Height, 46 mm.; length, 65 mm.; depth of valve, 8 mm.

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* Petrefactiæ Germaniæ, 1837, p. 136, Pl. CXX., Figs. 1*a*, *b*.

† R. Etheridge, Brit. Pal. Foss., Vol. I., 1888, p. 100 [recorded in error as *Pterinea laminosa*, Goldf.].

Affinities.—Our species appears to be closely allied to Whidborne's *Actinopteria hirundella**, from the Devonian of Lummaton, Devonshire. The latter species differs in the more forward position of the beaks, and in the straight posterior slope behind the umbones. Anotner species having the same type of shell is "*Pterinea*" *ventricosa*, Goldfuss.†

Horizon and Locality.—Silurian (Melbournian). East of Heathcote; coll. Geol. Surv. Vict. [7938.]

Genus Leiopteria, J. Hall, 1883.

Leiopteria cf. *oweni*, J. Hall. Plate V., Figs. 74, 74*a*.

Leiopteria oweni, J. Hall, 1884, Pal. New York, Vol. V., Pt. 1., Lamell. I., p. 170, Pl. XX., Fig. 10.

Observations.—The Victorian specimen is represented as a fairly complete cast in mudstone. So far as can be seen, it resembles the above species in its outline, and details of surface markings, such as the undulose growth lines and faint and comparatively widely-spaced radii. Hall's specimens came from the Hamilton Group of New York State.

Mr. R. Etheridge, jun., has described a species probably referable to this genus under the name of *Leiopteria ? australis*‡, from the Carboniferous, near West Maitland, New South Wales. Our species could scarcely be compared with the former, which has a shorter hinge-line, and consequently smaller posterior wing, whilst in outline it differs considerably, being altogether a higher shell. There are, moreover, no traces of radii in Etheridge's species.

Horizon and Locality.—Silurian (Yeringian). Kilsyth, Croydon; presented by Mr. Thos. Warr. [7939.]

Family **Pectinidæ.**

Genus Aviculopecten, McCoy, 1852.

Aviculopecten spryi, sp. nov. Pl. V., Fig. 75.

Description.—Shell small, sub-orbicular; ventral border almost circular; narrow at cardinal area, hinge-line short, ears well defined. Umbo fairly conspicuous. Surface broken by 20 grooves, the intermediate areas forming depressed convex ribs with a strong median striation and fainter lateral striæ.

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* Pal. Soc. Mon., Vol. XLVI., 1892, Devonian Fauna of the S. of England, p. 61, Pl. VI., Figs. 5, 6; Pl. VII., Fig. 4.

† Petrefactiæ Germaniæ, Vol. II., 1837, p. 134, Pl. CXIX., Fig. 2.

‡ Records Geol. Surv. N.S.W., Vol. V., Pt. IV., 1898, p. 178, Pl. XIX., Fig. 19.

The original is an impression of a left valve in blue mudstone, and the drawing has been made from a well-defined cast in wax.

Observations.—The above fossil is a typical *Aviculopecten*, in accordance with the emended definition of the genus given by J. Hall,* since it has a short hinge-line and well-defined ears.

Horizon and Locality.—Silurian (Melbournian). Yarra Improvement Works, S. Yarra; presented by Mr. F. P. Spry. [7940.]

Family **Modiolopsidæ**.

Genus MODIOLOPSIS, J. Hall, 1847.

Modiolopsis melbournensis, sp. nov., Pl. V., Figs. 76, 76*a*.

Description.—Shell small, sub-quadrate, elongate, compressed posteriorly; length rather less than twice the height. Cardinal line nearly straight; ventral margin parallel. Anterior extremity narrowly rounded, and incurved under the prominent sub-anterior beaks. Posterior extremity broadly rounded, and meeting the hinge-line at an obtuse angle. Umbonal ridge extending from the beaks to near the postero-ventral angle. Greatest convexity of surface in the umbonal region; ventral area somewhat depressed. Surface marked by fine, irregularly concentric growth-lines.

Measurements.—Length, 16 mm.; height, 9 mm.

Affinities.—A form nearly allied to the above is *Modiolopsis solenoides*, Sowerby, sp.†, from the Upper Ludlow, near Bridgenorth, England. It differs from our species, however, in its greater compression, less prominent beaks, and in having a broad median depression in the ventral region.

Horizon and Locality.—Silurian (Melbournian). Yarra Improvement Works, S. Yarra. [7941.]

Modiolopsis complanata, Sowerby, sp. Pl. V., Fig. 77.

Pullastra complanata, Sowerby, 1839, in Murchison's Silurian System, p. 609, Pl. V., Fig. 7.

Modiolopsis complanata, Sow. sp., McCoy, 1852, Brit. Pal. Foss., p. 266.

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* Pal. N. York, Vol. V., Pt. I., 1884, Lamell. I., p. XII.

† Siluria, 3rd ed., 1859, Pl. 23, Fig. 9 ["*Orthonota* (?*Cypricardia*) *solenoides*"].

Observations.—The Middle Devonian fossil identified by J. Phillips* as *? Pullastra complanata,* Sowerby, is distinct from the Silurian fossil, and is not related to *Modiolopsis,* since the posterior cardinal area is not compressed nor expanded, whilst the beaks are not situated so far forward. The Victorian specimen agrees in almost every detail with Sowerby's species, which in Great Britain occurs in the Wenlock, the Upper Ludlow, and the Tilestone Series.

Measurements.—The Victorian specimen has a length of 18.5 mm.; height, 11 mm.

Horizon and Locality.—Silurian (Melbournian). This striking species was found by Mr. F. P. Spry in the blue mudstone of the Yarra Improvement Works, S. Yarra, and presented by him to the National Museum. [7942.]

Modiolopsis nasuta, Conrad sp., var. *australis,* nov.
Plate VI., Fig. 78.

References to type form—

Cypricardites nasuta, Conrad, 1841, Ann. Rep., p. 52.

Cypricardites nasuta, Emmons, 1842, Geol. Rep., p. 403, Fig. 4.

Modiolopsis nasuta, Conrad sp., J. Hall, 1847, Pal. N. York, p. 159, Pl. XXV., Fig. 7.

Orthonotus nasutus, Conrad sp., McCoy, 1852, Brit. Pal. Foss., p. 275, Pl. 1 I., Fig. 23.

Orthonota nasuta, Conrad sp., Salter, 1859, in Murchison's Siluria, 3rd ed., p. 74, fossils 12, Fig. 12. Etheridge, 1888, Foss. Brit. Ids., Vol. I., Palæozoic, p. 108.

Observations.—Those elongate and modioliform shells which have no sharp posterior umbonal ridge, and in which the cardinal line is more or less curved, may be justifiably separated from the genus *Orthonota* as now understood, and placed with *Modiolopsis* (as restricted by McCoy).† The above shell is an example of such, which, although not so strongly arched in the umbonal region, yet seems to possess all the essential characters of Hall's genus.

It is interesting to note that the specific form is widely distributed, and there seems no reason to doubt that the Australian example is generally comparable with both the N.

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* Pal. Foss. Devon and Cornwall, 1841, p. 35, Pl. 17, Fig. 56.

† Brit. Pal. Foss., p. 265.

American and British specimens. The previously-recorded horizons for the specific form are at the top of the Ordovician (Hudson River Group and the Caradoc series).

The present variety is distinguished from the type species by its shorter and stouter form, and less pronounced nasute anterior extremity.

Horizon and Locality.—Silurian (Melbournian). In the hard black shale, Domain-road, S. Yarra; collected and presented by Mr. F. P. Spry. [7943.]

Genus GLOSSITES, J. Hall, 1885.

Glossites victoriæ, sp. nov. Plate VI., Fig. 79.

Description.—Shell small, compressed, elongate ovate, narrow in front, broad behind. Hinge line slightly curved. Beaks sub-anterior, depressed. Posterior margin strongly curved; ventral margin gently curved and truncately rounded at the anterior extremity. Umbonal convexity gradually becoming more depressed on approaching the postero-ventral margin. Shell texture thin; surface concentrically wrinkled with irregular lines of growth.

Measurements.—Height, 9.5 mm.; length, 16.5 mm.; depth of valve at umbo, 3 mm.

Affinities.—The only form of this genus with which the above species can be at all closely compared is *G. depressus*, J. Hall,* from the Chemung Group of Ithaca and Elmira in the State of New York. That species, however, has a more generally depressed shell, and the beaks are more acute.

Horizon and Locality.—Silurian (Yeringian). Croydon, near Lilydale; presented by Mr. Thos. Warr. [7944.]

Genus GONIOPHORA, Phillips, 1848.

Goniophora australis, sp. nov. Pl. VI., Fig. 80.

Description.—Shell sub-ovate, elongate; length about twice the height. Beaks large and anterior, strongly incurved toward the ventral margin. Anterior extremity of the shell narrow, very broad behind. Umbonal ridge prominent and sharp (in the type-specimen the posterior extremity of the shell is bent forward against the umbonal ridge). Basal edge sinuously curved; rising up to, and terminating just below, the beaks, at a sharp angle. Surface ornamented with numerous bifurcating lines of growth.

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*Pal. N. York, 1885, Vol. V., Pt. I., Lamell. II., p. 496, Pl. XL., Figs. 15, 17; Pl. XCVI., Fig. 12.

Measurements.—Length, about 23 mm.; height, 10.5 mm.

Observations.—This form at once reminds one of *G. cymbæformis*, Sow. sp.*, which ranges throughout the Silurian in the British Isles. That species, however, is not so conspicuously marked with the lines of growth, which in our specimen are closely set and strikingly bifurcated. Another form somewhat allied, but having more numerous growth striæ, and a higher shell, is *G. consimilis* of Billings† from the Silurian of Nova Scotia.

Horizon and Locality.—Silurian (Yeringian). In mudstone N. of Lilydale. Presented by the Rev. A. W. Cresswell, M.A. [989.]

Goniophora cf. *glaucus*, J. Hall sp. Pl. VI., Fig. 81.

Sanguinolites glaucus, Hall, 1870, Prelim. Notice, Lamell, 2, p. 38.

Goniophora glaucus, Hall, 1885, Pal. N. York, Vol. V., Pt. I., Lamell. II., p. 299, Pl. XLIII., Fig. 16; Pl. XLIV., Figs. 10-17.

Observations.—Our specimen is imperfect, but the anterior and most characteristic part of the shell is represented.

The habit of the shell is short. The surface is finely striated, and the striæ turn up at a steep angle over the umbonal ridge; this latter feature itself indicates a short form. The beaks are small and strongly incurved, whilst the umbonal ridge is sharp and widely curved. Hall's specimens came from the Hamilton Group of New York State.

Horizon and Locality.—Silurian (Melbournian).—From the mudstone of the Yarra Improvement Works, S. Yarra. Presented by Mr. F. P. Spry. [7945.]

Family **Pleurophoridæ.**

Genus CYPRICARDINIA, J. Hall, 1859.

Cypricardinia contexta, Barrande. Plate VI., 82, 83, 84.

Pterinea ? planulata, Salter *pars*, (*non* Conrad), 1848, in Phillips, Mem. Geol. Surv. Gr. Brit., Vol. II., Pt. I., p. 368, Pl. XXIII., Figs. 2 and 4.

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* Cypricardia cymbæformis, Sow., in Murchison's Silurian System, Pt. II., 1839, p. 602, Pl. III., Fig. 10*a*, p. 609, Pl. V., Fig. 6.

† Pal. Fossils, Geol. Surv. Canada, Vol. II., Pt. I., p. 135, Pl. VIII., Fig. 8

Cypricardinia nitidula, var. *contexta*, Barrande, 1881, Syst. Sil. Bohême, Vol. VI., Pt. I., Pl. 257, Fig. IV., 19-24.

Observations.—Barrande's *Cypricardinia nitidula* is probably the same form as *C. planulata*, and it therefore falls into the synonymy of the latter species. The variety *contexta* of the same author, however, is undoubtedly similar to some of the British fossils described by Salter under Conrad's name of *C. planulata*, but from which they differ in having a secondary interlamellar ornament. The Victorian specimens show the striæ to be often arranged in chevron fashion, and a tendency in this direction is indicated in one of Salter's figures (Fig. 4, loc. cit.), shown by the peculiar twist of the radii. The Bohemian, British and Victorian fossils, having a similar ornamentation, may perhaps be more conveniently referred to as *Cypricardinia contexta*, Barrande. The British examples of *C. contexta* were described by Salter as being pretty generally distributed through the Wenlock and L. Ludlow series, where it appears to be associated, as in Bohemia, with *C. planulata*. The Bohemian examples are recorded from Stage Ff_2, which by Kayser and others is now considered to be Lower Devonian, although formerly placed in the Silurian.

Another striated form of the same type of shell as the above is to be found in Sandberger's *C. crenistria*,* represented by the more highly convex right valve. In this species, however, the striæ are essentially regular and radial.

Horizon and Locality.—Silurian (Yeringian). From the parish of Yering, coll. Geol. Surv. Vict., 1862; north of Lilydale, presented by the Rev. A. W. Cresswell, M.A.; from a shallow well near Croydon, presented by Mr. Thos. Warr. [7946, 2241-2].

Family **Lucinidæ**.

Genus PARACYCLAS, J. Hall, 1843.

Paracyclas siluricus, sp. nov. Pl. VI., Figs. 85, 85*a*.

Description.—Shell orbicular, length equal to the height; more or less strongly convex, compressed in the cardinal region. Beaks central, prominent, roundly acuminate. Anterior border not so widely rounded as the posterior, and less compressed.

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* Die Versteinerungen des rheinischen Schichten Systems in Nassau, 1856, p. 263, Pl. XXVIII., Figs. 5, 5*a*, *b*.

Ornamented with concentric rings of growth, appearing as irregular folds, and most strongly marked near the extremities. All the examples known at present from Victoria are in the form of sandstone casts, so that the finer markings, if any, have perchance been lost. In wax squeezes taken from these casts there seem to be faint traces of a feeble radial, linear sculpturing, such as is seen in *Paracyclas lineata*, Goldfuss sp.*, which, by the way, our species otherwise resembles, with the exception that the latter is more regularly convex over the whole surface.

Measurements.—Figured specimen: Length, 15.5 mm.; height, 15.5 mm.; depth of valve, 3.5 mm.

Observations.—The present species resembles McCoy's *Anodontopsis bulla*† in its general shape, but differs in the coarser sculpturing of the shell-surface. The *A. bulla*, McCoy, does not appear to show any decided affinities with the other species described under the generic name *Anodontopsis* by McCoy, and seems to be a typical example of the earlier described genus *Paracyclas*.

It is of much interest to record that McCoy indicated the actual specimens with which I am now dealing as "a new form of *Anodontopsis* allied to *A. bulla*," by a pencil note written on the tablet of a mounted series in the Museum. The generic name *Anodontopsis*, besides being ante-dated by Paracyclas, appears to embrace three generic types as exemplified by McCoy's published species in his "British Palæozoic Fossils," as follow:—

Anodontopsis bulla, McCoy = *Paracyclas*, J. Hall, 1843.

A. angustifrons, McCoy = *Modiomorpha*, J. Hall, 1870.

A. quadratus, McCoy = *Cypricardella*, J. Hall, 1856 (*Microdon*, Conrad, 1842—pre-occupied by Agassiz's genus).

Another species which may be cited for comparison with ours is *Paracyclas elliptica*, J. Hall,‡ from the Corniferous Limestone and the Hamilton Group of the United States and Canada. It is, however, not so high, and the liræ are more distinct and more closely set.

Horizon and Locality.—Silurian (Melbournian). Coll. Geol. Surv., Moonee Ponds Creek, Flemington. Ranges east of Heathcote, B^b 50, very common. [7947 (type), 7948.]

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* Petrefactiæ Germaniæ, 1834-40, p. 227, Pl. CXLVI., Figs. 8*a*, *b*.

† *Lucina bulla*, McCoy sp., Syn. Silur. Foss., Ireland, 1846, p. 17, Pl. II., Fig. 1. *Anodontopsis bulla*, McCoy, 1852, Brit. Pal. Foss., Pt. II., p. 271, Pl. 1K., Figs. 11-13.

‡ Pal. N. York, Vol. V., Pt. I., 1885, Lamell. II., p. 440, Pl. LXXII., Figs. 23-33; Pl. XCV., Fig. 18.

Paracyclas siluricus, var. *heathcotiensis*, nov. Pl. VI., Figs. 86, 86*a*.

Description.—Suborbicular, rounded in front, subtruncate behind. Beaks central, salient and subacuminate. sharper than in the preceding species. Valves strongly convex, especially in the umbonal region, where they become almost ridge-like; superficial markings in the form of fine concentric striæ.

Measurements.—Length, 13.5 mm.; height, 13.5 mm.; depth of valve, 4 mm.

Observations.—This variety presents marked differences from the foregoing species, but in view of the fact that only a single example has occurred up to the present, and in association with the specific form, it will be safer for the present to regard it merely as a variety. In common with the type form, the figured specimen shows obscure indications of a radial lineation of the shell.

Horizon and Locality.—Silurian (Melbournian). Ranges east of Heathcote, coll. Geol. Surv., Vict., B^b 50. [988.]

INDEX TO VICTORIAN SILURIAN PELECYPODA, WITH REFERENCES TO THEIR GEOLOGICAL HORIZONS.

M = Melbournian or older Silurian ; Y = Yeringian or younger Silurian.

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EXPLANATION OF PLATES.

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Fig.

1. *Orthonota australis*, sp. nov. [Type.] Moonee Ponds Creek. [7869.] Nat. size.
2. *Grammysia abbreviata*, sp. nov. [Type.] S. Yarra. [7871.] ×2
3. *Parallelodon spryi*, sp. nov. [Type.] Wandong. [7950.] Nat. size.
4. *Leptodomus maccoyianus*, sp. nov. [Type.] Broadhurst's Creek. [976.] × 2.
5. *L. heathcotiensis*, sp. nov. [Type.] Heathcote. [987.] ×2.
6. *Palæanatina* cf. *solenoides*, J. Hall. S. Yarra. [7875.] ×2.
7. *Edmondia perobliqua*, sp. nov. [Type.] S. Yarra. [7876.] ×$\frac{13}{11}$.
8. *E. perobliqua*, sp. nov. S. Yarra. [7877.] ×2.
9. *E. perobliqua*, sp. nov. Domain Rd., S. Yarra. [2239.] ×$\frac{3}{2}$.
10. *Sphenotus warburtonensis*, sp. nov. [Type.] Right valve, internal cast. Reefton, Warburton. [2240.] Nat. size.
11. *Cardiola cornucopiæ*, Goldfuss sp. S. Yarra. [7878.] Nat. size.
12. *C. cornucopiæ*, Goldfuss sp. Moonee Ponds Creek. [978.] Nat. size.
13. *Panenka planicosta*, sp. nov. [Type]. Mount Matlock. [7879.] ×4
14. *P. cingulata*, sp. nov. [Type.] McMahon's Creek, Upper Yarra. [2263.] Nat. size.
15. *Paracardium filosum*, sp. nov. [Type.] From a wax impression of an external mould. Starvation Creek, Upper Yarra. [7881.] ×2.
16. *P. filosum*, sp. nov. Cardinal aspect of same ×3.

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17. *Ctenodonta portlocki*, sp. nov. Wilson's Station, Lilydale. [7884.] ×2.
18. *C. portlocki*, sp. nov. [Type.] S. Yarra. [7883.] ×2.
19. *C. portlocki*, sp. nov. S. Yarra. [7885.] ×2.
20. *C. portlocki*, sp. nov. S. Yarra. [7886.] ×2.
21. *Nuculites maccoyianus*, sp. nov. [Type.] S. Yarra. [7887.] ×2
22. *N. maccoyianus*, sp. nov. Junction of Woori Yallock and Yarra. [7888.] ×2.
23. *N. maccoyianus*, sp. nov. S. Yarra. [7889.] ×2.
24. *N. coarctatus*, Phillips, sp. A short variety. S. Yarra. [7890.] ×2.
25. *N. coarctatus*, Phill., sp. Typical form, from W. of Mt. Disappointment. [7891.] ×2.
26. *N. subquadratus*, sp. nov. W. of Mt. Disappointment. [977.] ×2
27. *N. subquadratus*, sp. nov. [Type.] ×2. 27A, Anterior of valve more highly magnified to show surface ornament. N. of Yan Yean. [7892.] ×4.
28. *N. jutsoni* sp. nov. [Type.] Wandong. [7893.] ×2
29. *Nucula melbournensis*, sp. nov. Internal mould. S. Yarra. [7896.] ×2.

30. *Nucula melbournensis*, sp. nov. A sub-orbicular variety. Domain Rd. sewer, S. Yarra. [985.] × 2.
31. *N. melbournensis*, sp. nov. [Type.] 31A, umbonal aspect of left valve. S. Yarra. [7895.] × 2.
32. *N. ? melbournensis*, sp. nov. 32A, antero-dorsal view. Merri Creek, Kalkallo. [7879.] × 2.
33. N. ? *melbournensis*, sp. nov. Attached valves. 33A antero-dorsal profile of valves. S. Yarra. [7898.] × 2.
34. *N. umbonata*, sp. nov. [Type.] Kilmore. [7899.] × 2
35. *N. umbonata*, sp. nov. Inner surface of valve showing cardinal line and ligament pit. Yan Yean. [7900.] × 2.
36. *N. arcæformis*, sp. nov. [Type.] Domain Rd. sewer, S. Yarra. [7901.] × 2.
37. *N. taylori*, sp. nov. [Type.] S. Yarra. [7907.] × 2.
38. *N. taylori*, sp. nov. Wax impression of an internal mould. Broadhurst's Creek, E. of Kilmore. [7908.] × 2.

III.

39. *Nucula opima*, J. Hall, sp., var. *australis*, var. nov. Yan Yean. [7910.] × 2.
40. *N. opima*, J. Hall, sp., var. *australis*, var. nov. [Type.] Yan Yean. [7909.] × 2.
41. *N. opima*, J. Hall, sp. var. *australis*, var. nov. S. Yarra. [7911.] × 2.
42. *N. opima*, J. Hall, sp., var. *australis*. Internal cast. Fraser's Creek, Springfield. [965.] × 2.
43. *N. opima*, J. Hall sp., var. *australis*, var. nov. Abnormal form, South Yarra. [7912.] × 2.
44. *N.* cf. *lirata*, Conrad sp. Yan Yean. [7914.] × 3.
45. *N. lamellata*, J. Hall. A short variety. Broadhurst's Creek, E. of Kilmore. [2252.] × 2.
46. *N. lamellata*, J. Hall. Schist Hill, Merri Creek. [2243.] × 2.
47. *Palæoneilo victoriæ*, sp. nov. Left valve. [Type.] S. Yarra. [7915.] × 2.
48. *P. victoriæ*, sp. nov. Elongate form; the two valves with the cardinal lines in position. S. Yarra. [7916.] × 2.
49. *P. victoriæ*, sp. nov. Right valve of an elongate and finely costate form. Domain Road sewer, S. Yarra. [7917.] × 2.
50. *P. raricostæ*, sp. nov. [Type.] Left valve. Junction of Woori Yallock and Yarra. [7918.] × 2.
51. *P. spectabilis*, sp. nov. Right valve. [Type.] S. Yarra. [7919.] × 2.
52. *P. spectabilis*, sp. nov. Interior of left valve and cardinal area of right valve. Jolimont, E. Melbourne. [7920.] × 2.
53. *P. producta*, sp. nov. [Type.] 53A, dorsal aspect of right valve. S. Yarra. [7921.] × 2.
54. *P. ? constricta*, Conrad sp. Cast of right valve. S. Yarra. [7923.] × 2.
55. *P.* cf. *brevis*, J. Hall. Merri Creek, Kalkallo. [968.] × 3
56. *P.* cf. *tenuistriata*, J. Hall. Merri Creek, Kalkallo. [967.] × 2.

IV.

57. *Parallelodon æqualis*, sp. nov. [Type.] S. Yarra. [7924.] ×3.
58. ? *Parallelodon kilmoriensis*, sp. nov. [Type.] Kilmore. [7925.] ×2.
59. ? *P.* cf. *kilmoriensis*, sp. nov. Swanston St. sewer. [7926.] ×2.
60. *Pterinea lineata*, Goldfuss. Left valve. Croydon, near Lilydale. [7927.] Nat. size.
61. *P. tenuistriata*, McCoy. S. Yarra. [7928.] × $\frac{3}{2}$
62. *Lunulicardium antistriatum*, sp. nov. [Type.] McMahon's Creek. [2257.] Nat. size.
63. *L. antistriatum*, sp. nov. Reefton, Warburton. [2255.] Nat. size.
63A. *L. antistriatum*, sp. nov. Vental margin of shell. Reefton, Warburton. [2255.] Nat. size.
64, 65. ? *Lunulicardium antistriatum*, sp. nov. Probably young examples. Mouth of Starvation Creek, Upper Yarra. [2260-61.] ×2.
66. *Ambonychia acuticostata*, McCoy. Cave Hill, Lilydale. [2268.] ×2.
67. *Mytilarca acutirostris*, sp. nov. [Type.] Junction of Woori Yallock and Yarra. [7930.] × 2.
68. *Actinopteria texturata*, Phillips, sp. (× 2): 68A, portion of shell-surface more highly magnified (× 4). Near Lilydale. [2264.]
69. *A. boydi*, Conrad, sp. Near Lilydale. [7933.] × 2.

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70. *Actinopteria boydi*, Conrad, sp. Another specimen to show variation in surface ornament. Croydon, near Lilydale. [7935.] Nat. size.
71. *A. asperula*, McCoy, sp., var. *croydonensis*, var. nov. Croydon, near Lilydale. [7936.] Nat. size.
72. *A.* cf. *sowerbii*, McCoy, sp. From a wax impression. Reefton, near Warburton, Upper Yarra. [7937.] Nat. size.
73. *A. heathcotiensis*, sp. nov. [Type.] Heathcote. [7838.] Nat. size.
74. *Leiopteria* cf. *oweni*, J. Hall. Left valve. 74A, profile. Croydon, near Lilydale. [7939.] Nat. size.
75. *Aviculopecten spryi*, sp. nov. [Type.] S. Yarra. [7940.] ×3.
76. *Modiolopsis melbournensis*, sp. nov. [Type.] Left valve. 76A, antero-dorsal profile of valve. S. Yarra. [7941.] ×2.
77. *M. complanata*, Sowerby, sp. S. Yarra. [7942.] ×2.

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78. *Modiolopsis nasuta*, Conrad, sp. var. *australis*, var. nov. [Type.] S. Yarra. [7943.] ×2.
79. *Glossites victoriæ*, sp. nov. [Type.] Right valve. Croydon, near Lilydale. [7944.] ×2.
80. *Goniophora australis*, sp. nov. [Type.] N. of Lilydale. [989.] × $\frac{3}{2}$.
81. *G.* cf. *glaucus*, J. Hall, sp. S. Yarra. [7945.] ×2.

82. *Cypricardinia contexta*, Barrande. Right valve. Croydon, near Lilydale. [7946.] × 2.
83. *C. contexta*, Barrande. Surface of right valve on the umbonal slope. Croydon, near Lilydale. [7946.] × 4.
84. *C. contexta*, Barrande. Left valve. Yering, Upper Yarra. [2242.] × 2.
85. *Paracyclas siluricus*, sp. nov. [Type.] 85A, umbonal aspect of left valve. Ranges E. of Heathcote. [7947.] × 2.
86. *P. siluricus*, var. *heathcotiensis*, var. nov. [Type.] 86A, umbonal aspect, left valve. Heathcote. [988.] × 2.
87. *Actinodesma* cf. *ampliata*, Phillips, sp. N. of Lilydale. [2267.] Nat. size.
88. *Prælucina ancilla*, Barrande. From a wax impression of a mould of a right valve in hardened mudstone. 88A, umbonal aspect. Maindample, Gippsland. [7882.] Nat. size.

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PLATE I.

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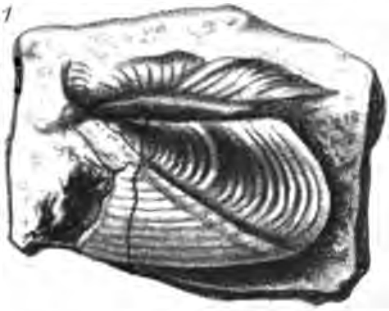

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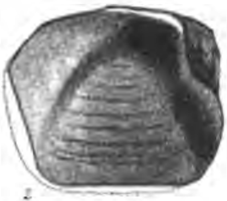

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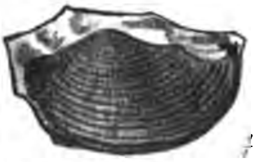

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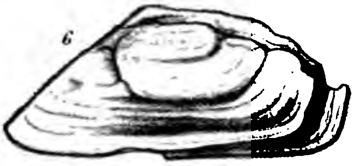

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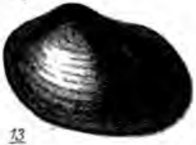

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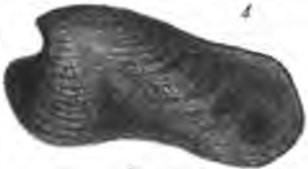

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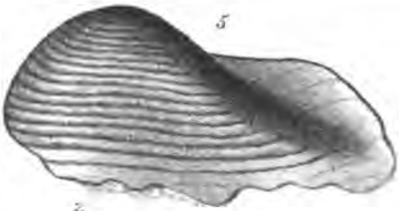

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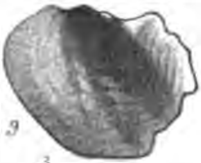

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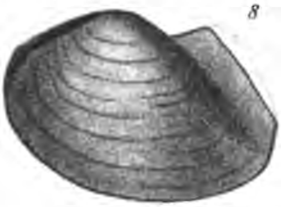

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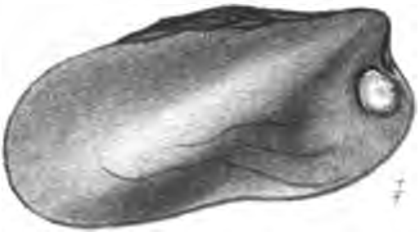

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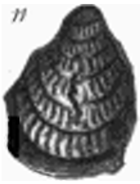

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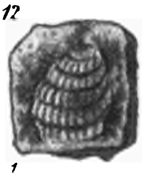

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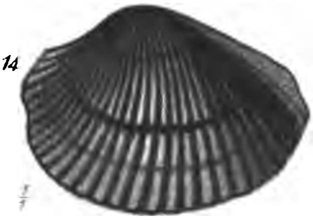

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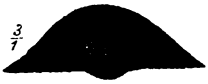

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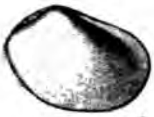
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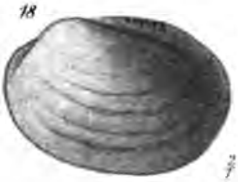
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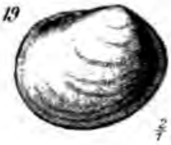
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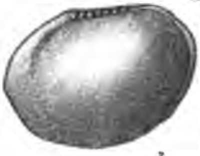
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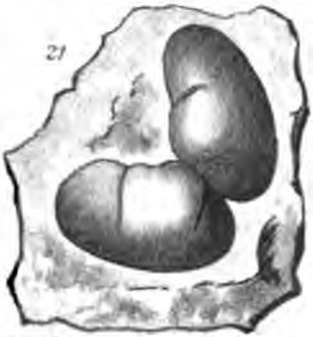
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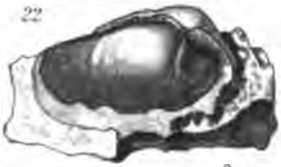
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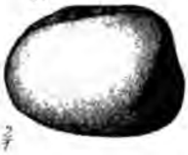
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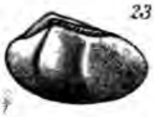
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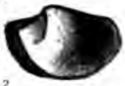
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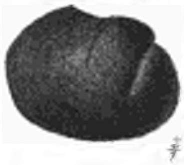
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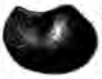
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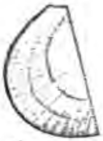
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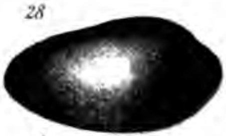
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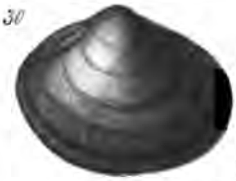
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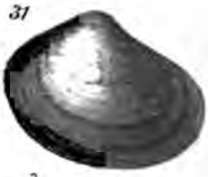
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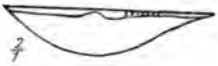
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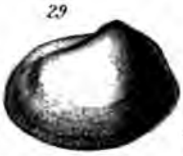
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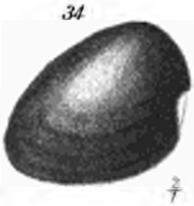
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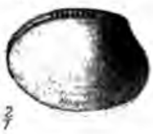
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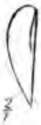
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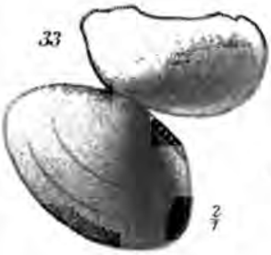
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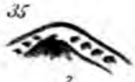
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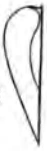
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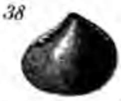
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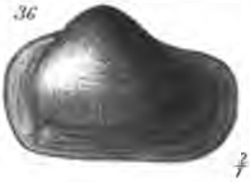
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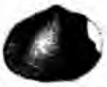
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PLATE III.

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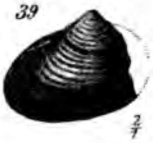

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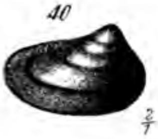

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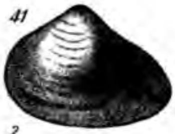

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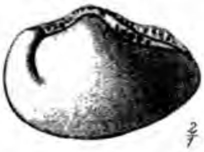

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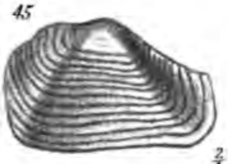

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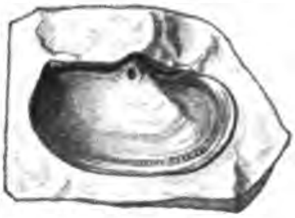

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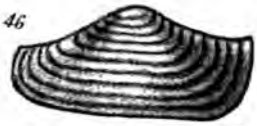

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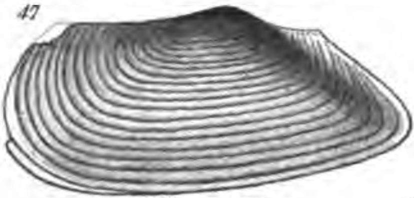

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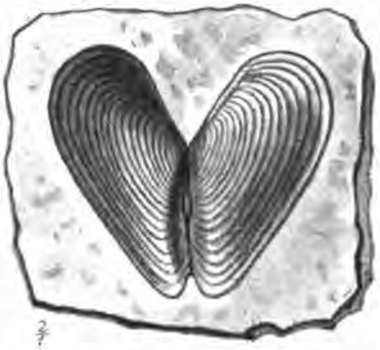

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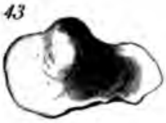

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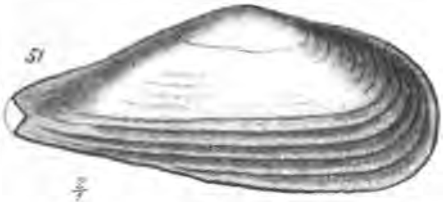

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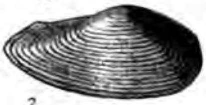

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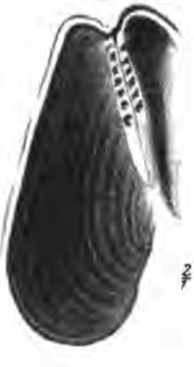

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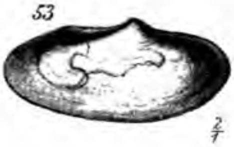

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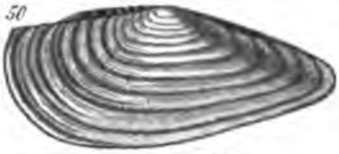

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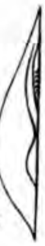

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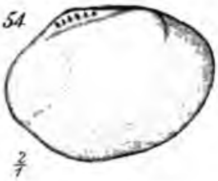

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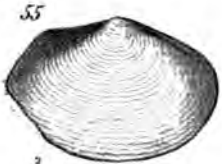

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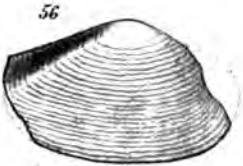

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PLATE IV.

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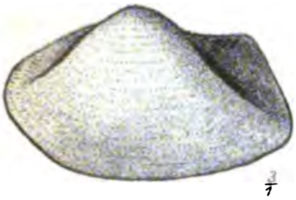

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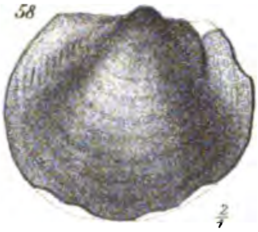

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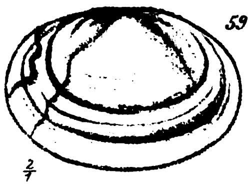

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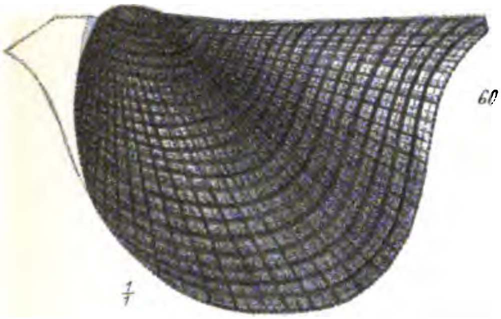

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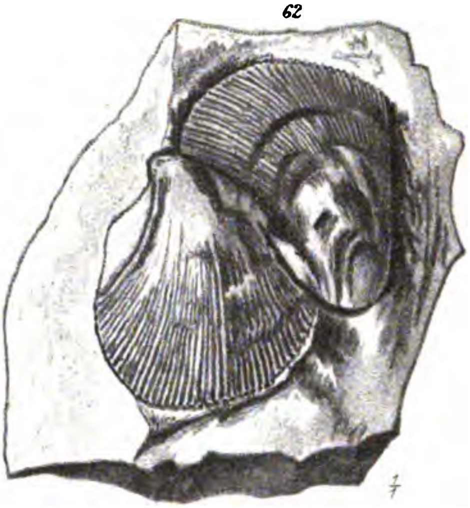

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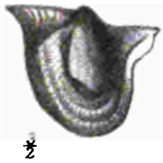

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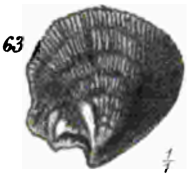

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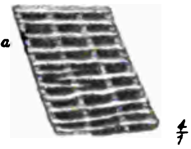

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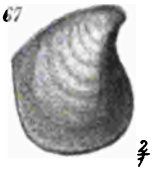

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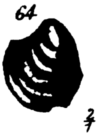

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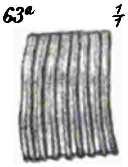

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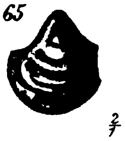

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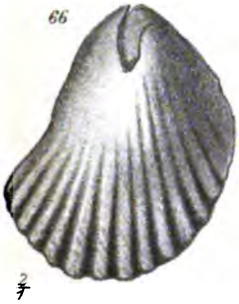

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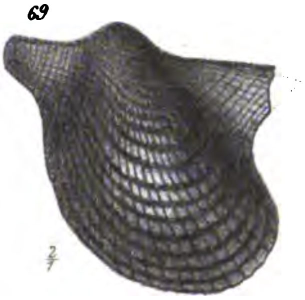

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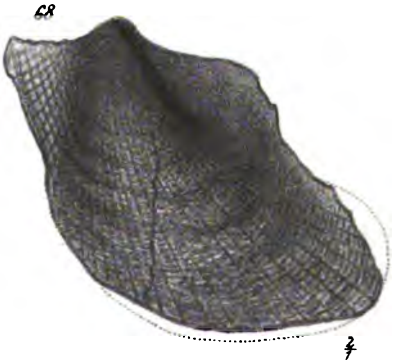

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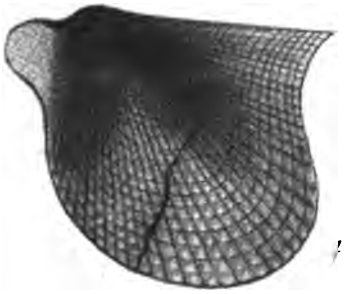
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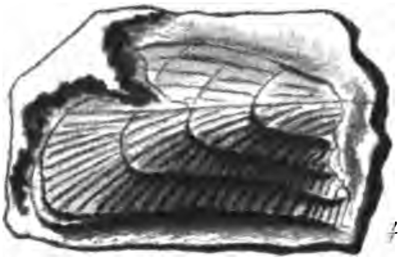

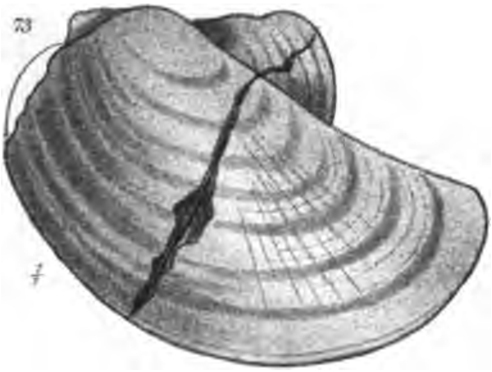
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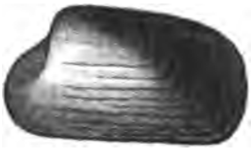

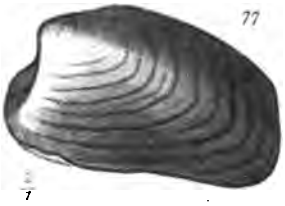
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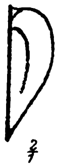
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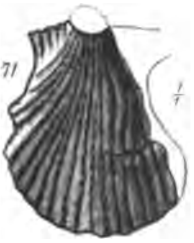
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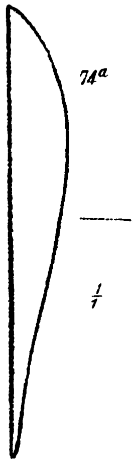
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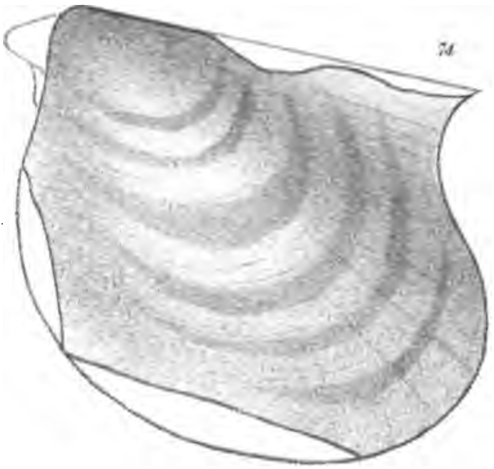
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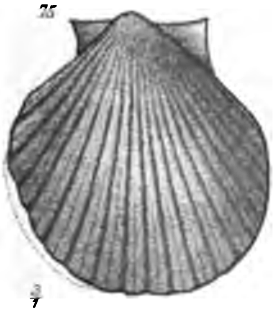
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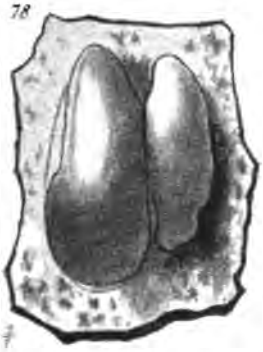

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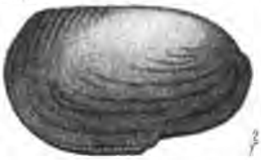

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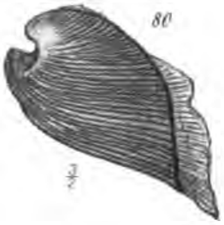

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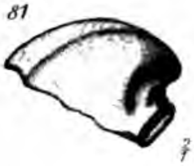

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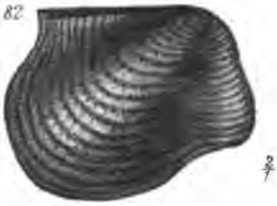

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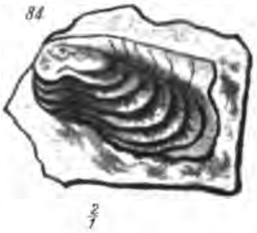

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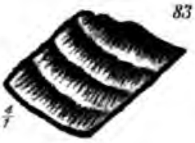

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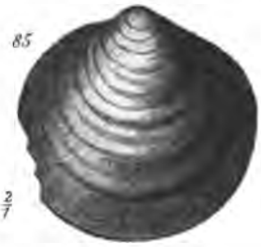

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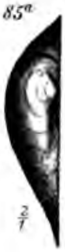

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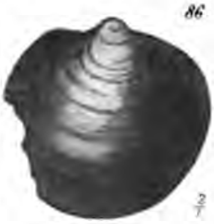

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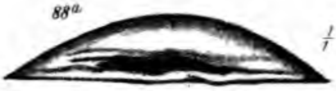

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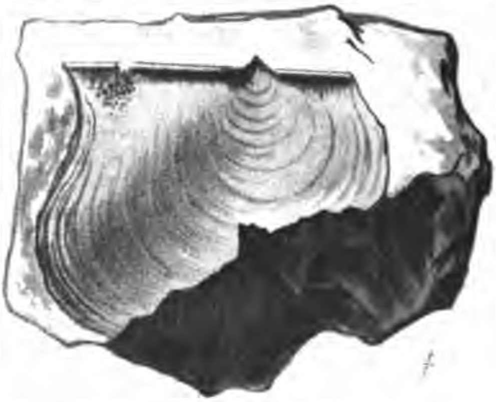

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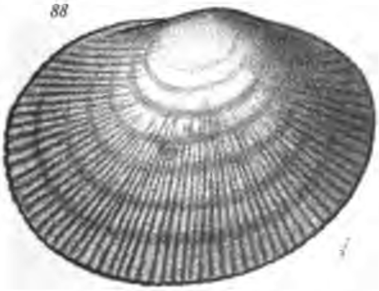

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ILLUSTRATED GUIDE

TO THE

Collection of Fossils

EXHIBITED IN THE

NATIONAL MUSEUM OF VICTORIA

By

FREDERICK CHAPMAN
A.L.S., Hon.F.Roy.Soc.S.A., F.G.S., &c.

Palæontologist of the Museum

1929

By Authority:
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Library

PREFACE.

Although the manuscript of this Guide to the Fossil Galleries was prepared some years ago, various circumstances prevented its publication at an earlier date.

Its preparation has been carried out by Mr. Frederick Chapman, who has occupied the position of Palaeontologist to the National Museum since 1902, and whose excellent work in advancing the knowledge of the Australian Fossil Fauna is so well known.

With few exceptions, all the figures have been especially prepared for this work by Mr. Chapman from photographs taken from the actual specimens shown in the cases.

This Guide is so arranged that the Australian fossils shown in the Eastern Gallery nearest the Russell-street entrance may be examined first. The exhibits in the Floor Cases and then those in the Wall Cases are described and noted, and lastly the Table Cases. The Table Cases are numbered 1 to 45, and contain a representative collection of the Australian Fossil Fauna and Flora, although by no means complete, on account of the limited space. To display an adequate Australian Fossil collection would occupy at least four times the space now allotted to it, and this could be drawn from material already stored in the Museum.

The arrangement of the Table Cases is in numerical order, and from Sub-recent to Cambrian. This series contains many described and figured types, the former being indicated by a red disc (holotypes) and the latter by a green one (plesiotypes, paratypes, and lectotypes).

In a Guide of limited extent it has only been possible to mention the more striking exhibits, and it does not convey any idea of the rich and varied collections which have been brought together and are available to students of research.

The building up of the extensive collections of both Australian and Foreign Fossils now in the Museum was largely due to the wide knowledge and foresight of the late Professor Sir Frederick McCoy, who held the position of Director of the Museum almost from its foundation until his death in July, 1899. The bulk of the foreign collection was acquired by him, some of the more important material being obtained from Krantz, of Bonn (mainly invertebrates); Thos. Bean, of Scarborough (Jurassic plants of Yorkshire, England—a collection only second to that of Cambridge); the Ammonite collection of 2,000 specimens from Dr. Thos. Wright; the English Oolite fossils of Dr. John Lycett (over 3,000 specimens) and several notable collections, including Paris Basin and Old Red Sandstone Fossils, from Robert Damon, of Weymouth.

The Australian Collection has been largely built up from specimens obtained by the Geological Survey, public donations, purchases, exchanges, and special collecting by the Palaeontologist.

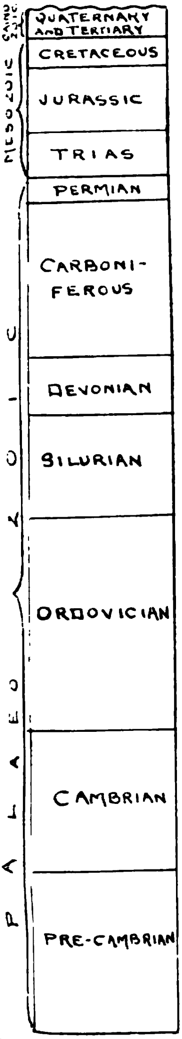
The more important of the separate collections are those of Geo. Sweet, Cresswell, Hall, Spry, Mulder and Robertson.

JAS. A. KERSHAW,
Curator.

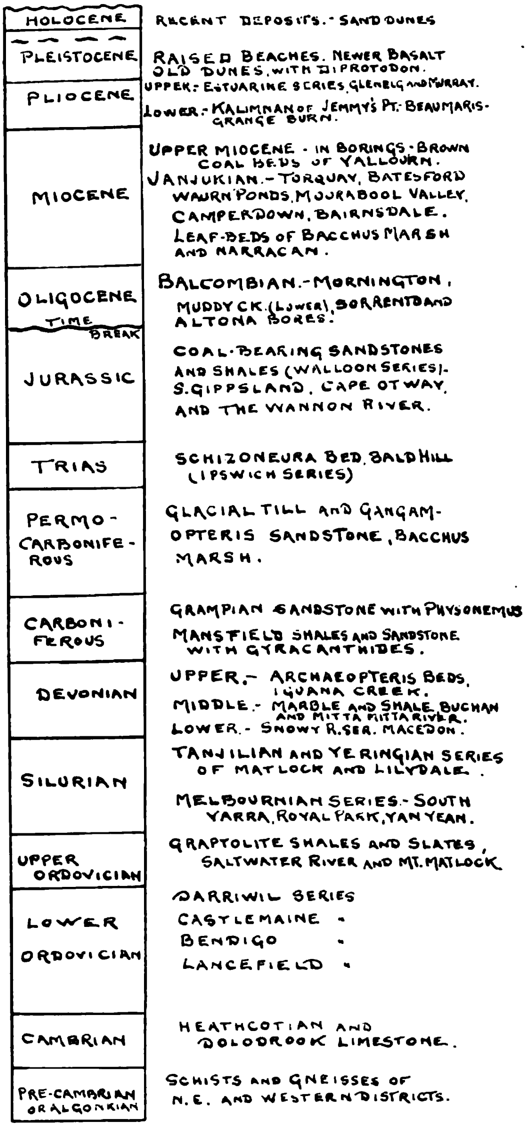
January, 1929.

V

View of Gallery of Foreign Fossils.



ENERALIZED TABLE OF GEOLOGICAL EPOCHS, SHOWING RELATIVE THICKNESS.



HOLOCENE	RECENT DEPOSITS.- SAND DUNES
PLEISTOCENE	RAISED BEACHES. NEWER BASALT OLD DUNES, WITH DIPROTODON.
PLIOCENE	UPPER:- ESTUARINE SERIES, GLENELG AND MURRAY. LOWER:- KALIMNAN OF JEMMY'S PT.- BEAUMARIS-GRANGE BURN.
MIOCENE	UPPER MIOCENE - IN BORINGS - BROWN COAL BEDS OF YALLOURN. JANJUKIAN.- TORQUAY, BATESFORD WAURN PONDS, MOORABOOL VALLEY, CAMPERDOWN, BAIRNSDALE. LEAF-BEDS OF BACCHUS MARSH AND NARRACAN.
OLIGOCENE	BALCOMBIAN.- MORNINGTON, MUDDY CK. (LOWER), SORRENTO AND ALTONA BORES.
TIME BREAK	
JURASSIC	COAL-BEARING SANDSTONES AND SHALES (WALLOON SERIES). S. GIPPSLAND, CAPE OTWAY, AND THE WANNON RIVER.
TRIAS	SCHIZONEURA BED, BALD HILL (IPSWICH SERIES)
PERMO-CARBONIFEROUS	GLACIAL TILL AND GANGAMOPTERIS SANDSTONE, BACCHUS MARSH.
CARBONIFEROUS	GRAMPIAN SANDSTONE WITH PHYSONEMUS MANSFIELD SHALES AND SANDSTONE WITH GYRACANTHIDES.
DEVONIAN	UPPER.- ARCHAEOPTERIS BEDS, IGUANA CREEK. MIDDLE.- MARBLE AND SHALE, BUCHAN AND MITTA MITTA RIVER. LOWER.- SNOWY R. SER. MACEDON.
SILURIAN	TANJILIAN AND YERINGIAN SERIES OF MATLOCK AND LILYDALE. MELBOURNIAN SERIES.- SOUTH YARRA, ROYAL PARK, YAN YEAN.
UPPER ORDOVICIAN	GRAPTOLITE SHALES AND SLATES, SALTWATER RIVER AND MT. MATLOCK
LOWER ORDOVICIAN	DARRIWIL SERIES CASTLEMAINE " BENDIGO " LANCEFIELD "
CAMBRIAN	HEATHCOTIAN AND DOLODROOK LIMESTONE.
PRE-CAMBRIAN OR ALGONKIAN	SCHISTS AND GNEISSES OF N.E. AND WESTERN DISTRICTS.

GEOLOGICAL TABLE OF THE SEDIMENTARY ROCKS OF VICTORIA.

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GUIDE TO THE FOSSILS IN THE NATIONAL MUSEUM.

INTRODUCTION.

Fossils, which we find embedded in the solid rock, or which we dig out of the ground, are the remains of once living animals and plants.

> Our marble halls, with all their quarried stones—
> What are they but the bleached and whitened bones
> Of countless generations piled on high.

The Limestone, the Mudstone, or the Sandrock which we often find enclosing fossils, may represent the deposit of an old sea-bed, a lake bottom, or the accumulation of a river or swamp. Over these ancient surfaces there once lived and crawled the extinct animals whose remains are now preserved as petrifactions. In the case of the plant remains, these may have been rooted in the mud of a swamp, if found in the position of growth, or they may have been washed down by rivers and streams, as, for example, in the case of the brown coal formation.

It was supposed by some of the ancient writers that these fossil remains were actually generated within the mud or slime and that they lived in the position where they are now found. Other authorities of the time thought them to be freaks of nature—*lusus naturae.*

Aristotle, the Greek philosopher, imagined fossils to have been produced by a plastic force in the rock, and this opinion was long accepted.

It was not until the beginning of the 18th century that the true nature of fossils was understood. It was also realized that these ancient animals could not all have lived at the same time, so that their presence was not easily explained by a Universal Flood.

Geological investigations, such as those made by Leonardo da Vinci, the great civil engineer and artist of the early part of the 16th century, proved that the land and sea had exchanged relative positions, and that what was once a sea-bed has become dry land.

The true SUCCESSION and the RELATIVE AGES of the ROCKS with the FOSSILS were discovered by William Smith (1769-1839). He was an English civil engineer, and he showed by his observations made on a journey through England and Wales that the rocks were superposed on one another according to their age, the oldest being found at the base of the series. Thus he was able to draw up a table of strata which showed this relationship of the beds.

A TABLE OF EUROPEAN STRATA on these lines, only more complete, is hung on the South Wall, near the staircase.

A smaller table, showing the VICTORIAN STRATA, is hung in the Australian Gallery near the entrance to the Australian zoological collection.

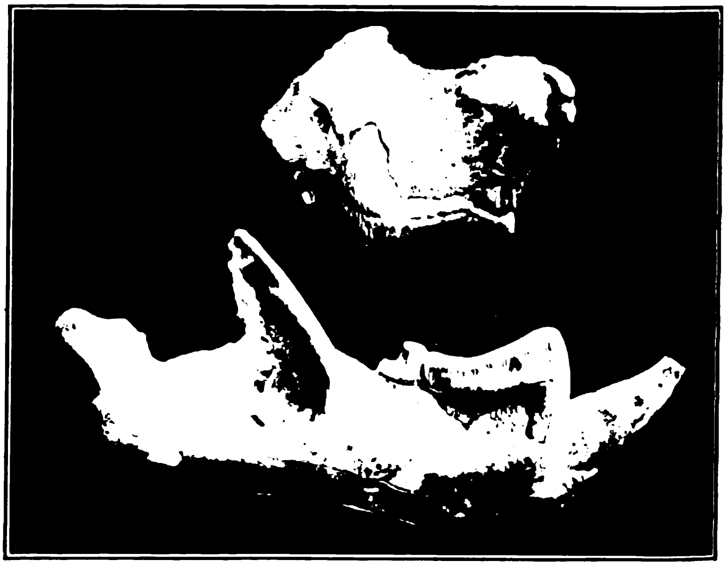

FIG. 1. *Thylacoleo carnifex* Owen.
Lower right and upper left jaws. Pleistocene. Buchan Caves, Gippsland.
(Original 7½ inches long.)

In earlier historic times, whilst the beds of fossiliferous rocks and their distribution were being studied, the fossil contents received attention at the hands of the naturalists Blumenbach, Cuvier, Lamarck, and Brongniart. They compared these fossils with living forms, and found that they belonged to kinds no longer living.

The science of Ancient Life, called Palaeontology (by H. D. de Blainville and Fischer de Waldheim), discusses these "fossils" or "things dug up" in relation to existing forms of life; it is also concerned with their distribution through the various strata of the earth's crust.

AN INTRODUCTION TO THE STUDY OF FOSSILS.

Visitors who are not familiar with the elements of this interesting study will do well to consult a series of eight Table-cases at the west end of the South Gallery. These cases contain a series of carefully selected specimens, both Australian and foreign, and there are also drawings, photographs, and descriptions, which altogether serve as a "Primer of Palaeontology." The head-lines of the groups of specimens are as follows:—

Examples of Fossils.
Ideas of the Ancients regarding Fossils.
How Animals and Plants have been Buried in the Stratified Rocks.
Fossiliferous Rocks.
Examples of the Hard Parts of Animals which are Usually Preserved as Fossils.
Examples of Plant Remains which are Usually Preserved as Fossils.
Evidence afforded by Fossils of Accompanying Conditions of Environment and Sedimentation.
Methods of Fossilization and the Various Conditions of Petrifaction.
Replacement of Organic Structures—Pseudomorphs.
The Distortion of Fossils.
Imitative Forms, or Pseudo-fossils.
On the Value and Significance of Fossils.
Type Fossils (108 species).
Variation in Fossil "Species."

RECENT ADDITIONS CASE.

Here are exhibited newly-described or recently-donated specimens, accompanied by simple diagrams and descriptive labels. These are changed from time to time.

AUSTRALASIAN FOSSILS.

These are Exhibited in the East Gallery.

The Wall-case of this Gallery contains a remarkably fine selection of the larger Australasian fossils; comprising specimens, shells, bones, and groups of fossils in their matrix.

In Australia and New Zealand many kinds of fossilized remains are found to be similar to those occurring in other parts of the world; some, however, are peculiar to this region and are consequently of especial interest.

Such are the extinct Marsupials, as **Diprotodon** (=" two front teeth," in reference to the upper incisors). This was a gigantic animal of the Pleistocene period, as large as a Rhinoceros and rather taller. The Diprotodon lived amongst the herbage and low forests, especially of the southern and eastern parts of Australia, which were well watered at that time, but became extinct in recent times owing in all probability to the diversion of rivers, now more or less dried up, which

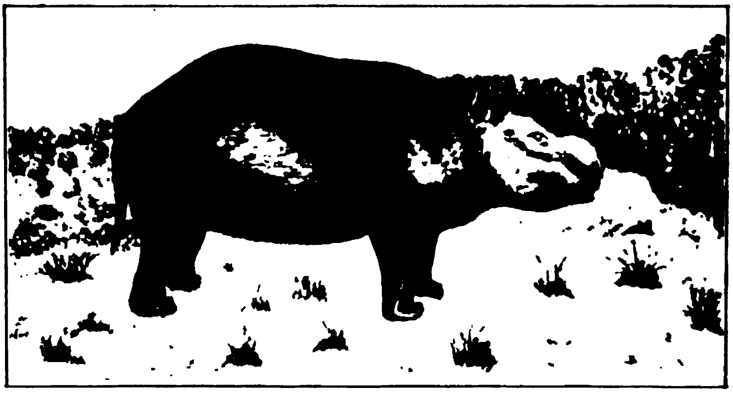

Fig. 2. *Diprotodon australis* Owen.

Restoration of the giant marsupial.

After C. H. Angas and F. Chapman.

then supplied moisture to these localities. A fine replica of the skeleton of the Diprotodon stands in a Floor-case in the centre of the Australasian Gallery, and other remains and casts from Queensland, Geelong, Colac, Mount Macedon, and Footscray are to be seen in the Wall-case of this Gallery.

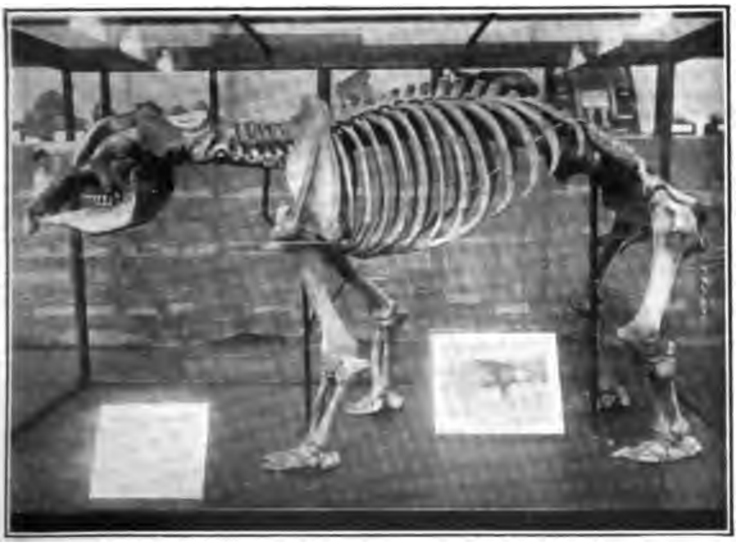

FIG. 3. SKELETON OF *Diprotodon australis* Owen.
Reproduced from Casts of Skeletons found at Lake Callabonna, South Australia, by Dr. E. C. Stirling.

The **NOTOTHERIUM** (="southern beast") was somewhat like the Diprotodon, but smaller and with a shorter and broader skull. Some authorities suppose this extinct animal to have carried a fleshy horn or proboscis. Its remains are found in Queensland, Tasmania, Victoria, and Western Australia. It is here represented by a cast of the cranium (see Wall-case), and by jaws and teeth (Table-case 4).

WYNYARDIA is another peculiar and extinct marsupial, having characters apparently connecting the Kangaroos with the Native Cats. Casts of the head, limb-bones, and vertebrae are seen in the Wall-case. It was living in Tasmania in about Upper Miocene times.

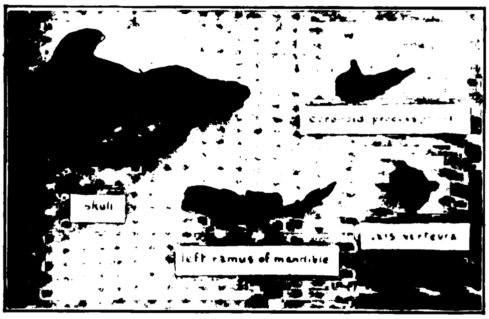

Fig. 4. ***Wynyardia bassiana*** **Spencer.**
Upper Cainozoic (*Turritella* bed), Table Cape, Tasmania.

Amongst the Cetaceans (Whales, Porpoises, and Dolphins) the Beaked Whales, MESOPLODON, are important. A very fine cranial rostrum from the Lower Pliocene of Grange Burn, Hamilton, is exhibited in the Wall-case. This form is identical with the species described by Owen and Huxley from the

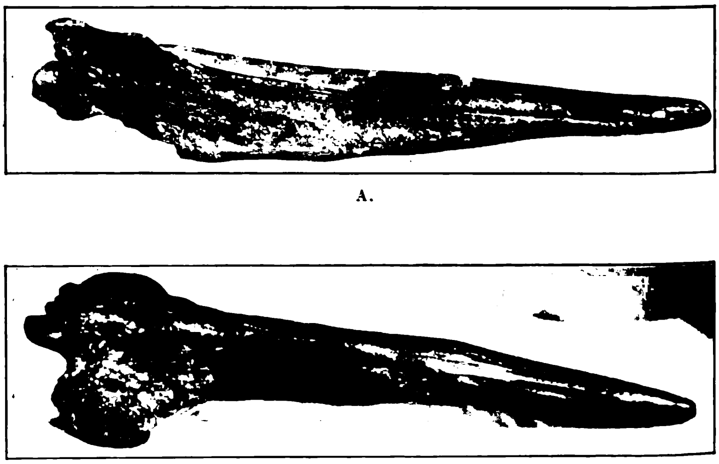

Fig. 5. CRANIAL ROSTRUM OF A BEAKED WHALE—*Mesoplodon compressus* (Huxley).
Kalimnan (Lower Pliocene). Grange Burn, near Hamilton, Victoria.
A = side view.
B = lower surface.

Red Crag of Suffolk, England. Huge bones, which represent ribs, vertebrae and parts of the limb-bones of great whales, are found from time to time in the Grange Burn and Beaumaris sandy marls. One of these ribs, found at Beaumaris, measures 64 inches in length. Other remains of whales (teeth and tympanic or ear-bones) are found in Table-cases 7 and 18. Amongst the teeth are those of SCALDICETUS, formerly known only from the Antwerp Crag of Belgium, but here represented by species from Muddy Creek (Oligocene) and Beaumaris (Lower Pliocene)—Table-cases 18 and 7. Another Sperm Whale is METASQUALODON, a widely distributed Australian species in the Tertiary marls and limestones of Miocene age (Table-case 18). For foreign examples of toothed Whales see the casts in the Foreign Fossil Gallery (Wall-case, Vertebrates). of ZEUGLODON from Malta and PROZEUGLODON from Egypt.

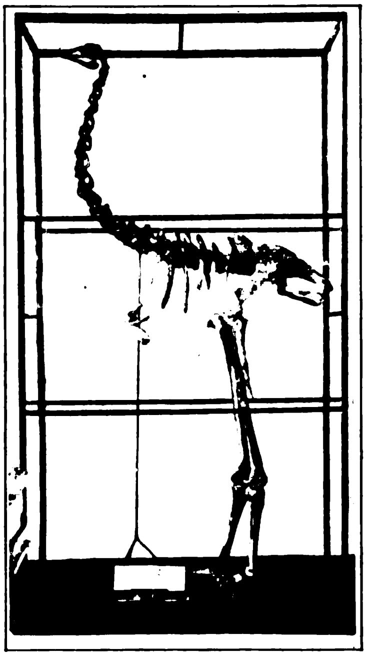

FIG. 6. *Dinornis maximus* Owen.
THE GREAT MOA.
Height along spine, 10ft. 8 in.
Pleistocene. New Zealand.

The fine skeletons of **Dinornis** *maximus*, the Great Moa, with a height of 10 feet 8 inches, and **Eurapteryx** *gravis*, the Heavy-footed Moa, adapted for running over rough ground, are shown in separate cases. Especially notable is the fine, re-constructed skeleton of a Madagascar Moa, **Aepyornis** *hildebrandti*, showing the short and broad breastbone and remains of a very small wing. In the same case is the great egg of a larger species of **Aepyornis**, the capacity of which is equal to 148 hen's eggs. Like the New Zealand **Apteryx**, this bird laid an enormous egg, compared with its size.

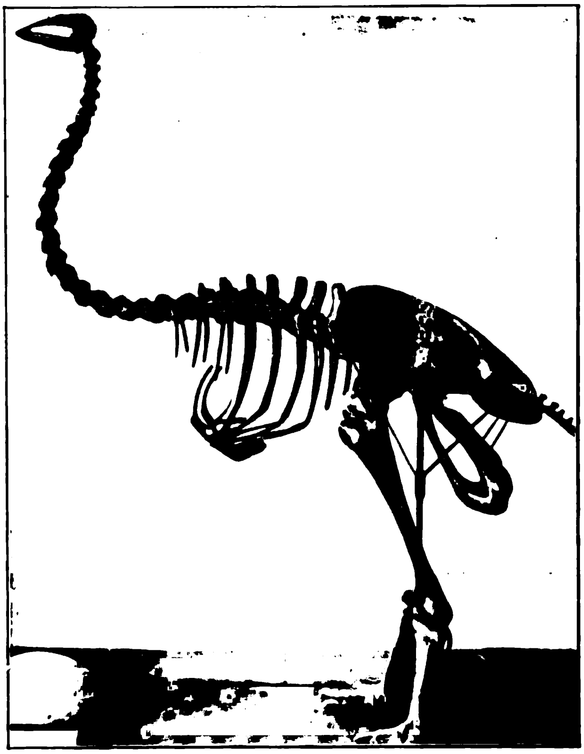

FIG. 7. RESTORED SKELETON, by Dr. C. W. Andrews, OF THE MADAGASCAR MOA (*Aepyornis hildebrandti*).

Late Pleistocene. Central Madagascar.

Giant Marine Reptiles were once abundant in the Cretaceous seas around Australia and New Zealand continents. ICHTHYOSAURUS *australis* is a typical Fish-lizard, having the limbs modified into enormous paddles by the multiplication of the digital bones. A fine head, paddle, and vertebrae, as well as the orbit, of a Flinders River species, are exhibited in the Wall-case of the East Gallery. The orbital region of the cranium shows the sclerotic plates lying over the eye-lens of this Fish-lizard which enabled the reptile to change its focus of vision when pursuing its prey. Vertebral bones of the long-necked Saurians (SAUROPTERYGIA) are seen in the Wall-case, from Central Australia. They are probably related to ELASMOSAURUS of the Upper Cretaceous of Kansas, U.S.A.

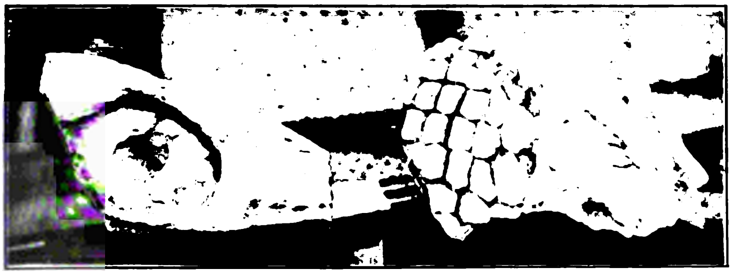

FIG. 8. HEAD AND PART OF PADDLE OF THE AUSTRALIAN FISH-LIZARD—*Ichthyosaurus australis* McCoy.
Lower Cretaceous. Flinders River, Queensland.

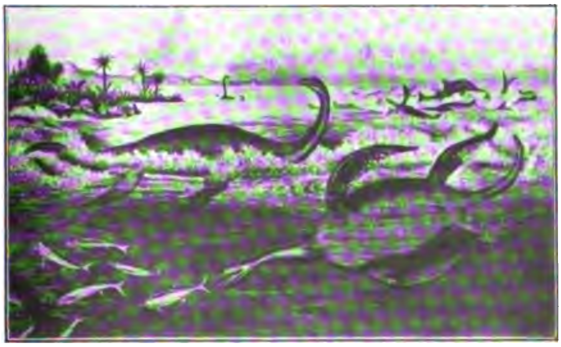

FIG. 9. IDEAL SEASCAPE IN THE LIASSIC PERIOD, WITH SAURIANS.
After E. Fraas.

Reference may here be made to a cast of the Sauropterygian, THAUMATOSAURUS, affixed to the wall of the South Gallery. A cretaceous marine Turtle, NOTOCHELONE *costata*, from Flinders River, Queensland, is represented by two well-preserved examples.

Amongst Fishes, the type specimen of BELONOSTOMUS *sweeti*, which was an elongate, predatory Ganoid (or armoured enamelled scale fish) is shown in the wall-case, along with the Jurassic fish PSILICHTHYS *selwyni*, from the Western District of Victoria. The block of limestone of Miocene age, from Batesford, should be noted, for it contains twenty-nine teeth of an extinct shark, ISURUS *retroflexus*, besides one other genus, CARCHARODON, related to the living Great White Shark.

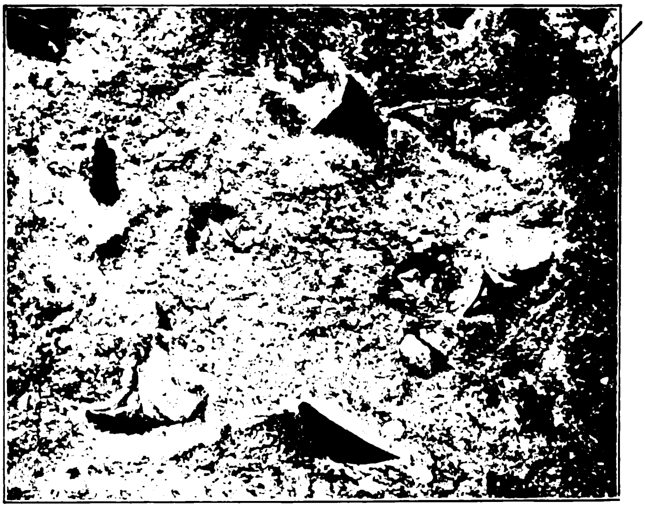

FIG. 10. BLOCK OF FORAMINIFERAL LIMESTONE from the Filter Quarries, Batesford, near Geelong, with 29 teeth of *Isurus* and 1 of *Carcharodon*, embedded.

Amongst shells of Mollusca, or Shell-fish, some specimens of fossil NAUTILUS and their related kinds are exhibited in the wall-case ; these include the largest known specimen of ATURIA, a flattened nautiloid form with curiously convoluted septal walls, from Muddy Creek, Hamilton. A fine natural mud-cast of NAUTILUS *geelongensis* from the Miocene of the Orbost district should here be noted. The giant Ammonite-like forms are represented by CRIOCERAS and ANCYLOCERAS from the Cretaceous of Queensland. Amongst the Gasteropods or Univalves, the Giant Cowrie (CYPRAEA *gigas*) from Muddy Creek and the enormous Volutes (PTEROSPIRA *validicostata*) are conspicuous. Of the Bivalves, the Oyster (OSTREA) is common in the fossil condition, forming oyster beds in the limestone deposits of Dartmoor, Bairnsdale, and Cape Otway, examples of which shells are shown here: some of these are indicated by their great thickness of shell-plates or lamellae to have been quite 100 years of age when covered by sediment.

The Hydroids (allies of the living "Sea-firs") are represented by some fine Graptolites (from *graphe*, I write; *lithos*, a stone), on slabs of slate from Lancefield, Bendigo,

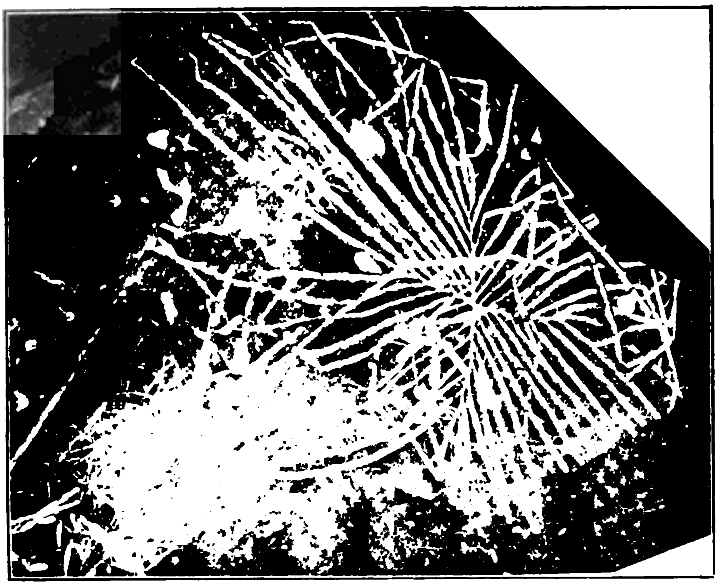

FIG. 11. *Goniograptus speciosus* T. S. Hall.
A GRAPTOLITE FROM THE LOWER ORDOVICIAN.
Black Forest, south-west of Woodend, Victoria.

and Woodend. These hydroids have been long extinct as they are confined to the older series of rocks or Palaeozoic slates ; they are of the greatest use in determining the zones or particular beds over large areas in the search for gold. An especially striking form of Graptolite shown here is a species of GONIOGRAPTUS (G. *speciosus*) from the last-named locality.

Corals are here shown from Silurian and Permocarboniferous strata, one of the more noteworthy specimens being a fine polished slab of coral limestone from the Thomson River, Gippsland, containing the "Sunstone Coral" (HELIOLITES) and the "Honey-comb Coral" (FAVOSITES).

Amongst Tertiary fossil leaves, some of the genus EUCALYPTUS are seen on a rock slab in the Wall-case ; they are interesting from the fact that they were embedded in volcanic dust showered down from the craters round Warrnambool. Triassic and Palaeozoic Ferns and fern-like plants are represented by THINNFELDIA from Mount Victoria, and GLOSSOPTERIS from Newcastle, in New South Wales. A fossil tree-trunk, ARAUCARITES, from the Stockton Colliery, New South Wales, is shown here ; it is probably related to living Australian conifers, as ARAUCARIA. One of these tree-trunks, turned into flint but with the structure of wood still within it, is shown about the middle of the Gallery.

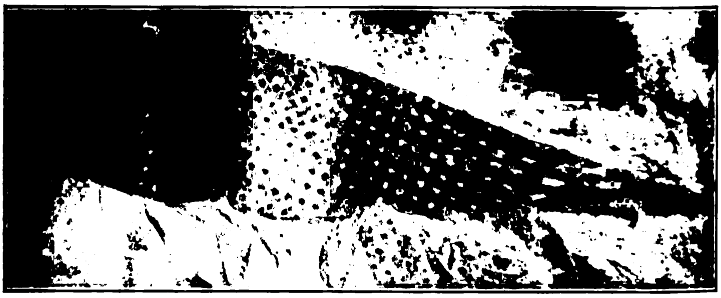

FIG. 12. LEAF OF *Glossopteris Browniana* Brongniart.
Permo-carboniferous of Newcastle, New South Wales (half nat. size).

AUSTRALASIAN FOSSILS.

TABLE CASES.

These are arranged in order of Geological Ages, from 1 to 45, beginning at the SUB-RECENT or HOLOCENE fossils and ending with the oldest, the CAMBRIAN.

The following specimens are of especial interest :—

A fine series of shells of living species from raised beaches and sunken estuaries. **Cases 1 and 2.**

Marsupial and other remains from Sub-recent and Pleistocene cave-floors, creek-beds, and sand-blows. Note the remains of the King Island extinct Emu (DROMAEUS *minor*), the remains of THYLACOLEO or Marsupial Lion, the Giant Kangaroos (MACROPUS *titan* and PROCOPTODON *goliah* ; also NOTOTHERIUM). **Cases 3 and 4.**

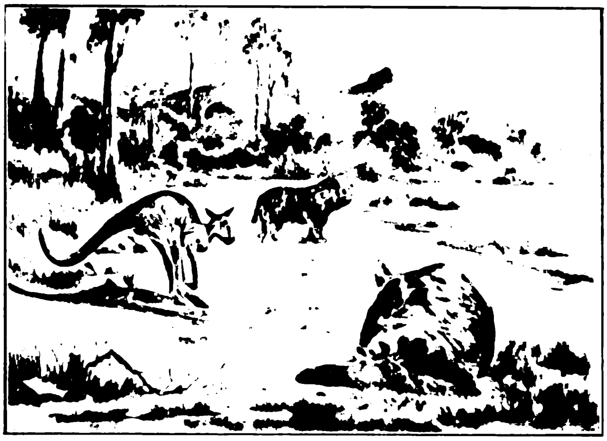

FIG. 13. IDEAL TASMANIAN LANDSCAPE IN THE PLEISTOCENE PERIOD. Showing extinct marsupials—*Palorchestes*, *Nototherium*, and *Phascolonus*. After Victor Henry.

These cases contain Lower Pliocene fossils, including a fine series of fruits, wood, and leaves from the buried river silts of the Deep Leads. Also a fine **Cases 5 to 7.**

collection of Sharks' and Whales' teeth (Isurus, Carcharodon, Scaldicetus, and Physetodon).

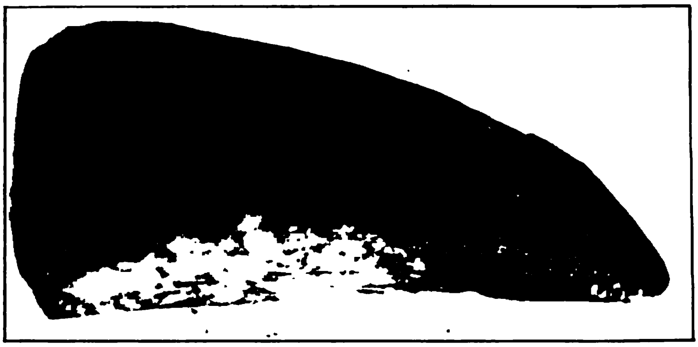

Fig. 14. Tooth of a Fossil Sperm Whale—*Scaldicetus macgeei* Chapn
L. Pliocene. Beaumaris, Port Phillip.

Cases 8 to 18. These contain Oligocene and Miocene fossils; amongst which may be noted fossil Leaves, Foraminifera

Fig. 15. Leaves of *Nothofagus risdoniana* (Ettingshausen), in Tertiar
travertine.

Lindisfarne, Hobart, Tasmania.

and Sponges (case 8). Here may be seen the remarkable leaf impressions in travertine limestone from Hobart.

Here is shown a beautiful and unique series of Australian Tertiary Corals. Diagrams of the structure of the calyx accompany the chief types. **Case 9.**

A typical set of Sea-urchins or Echinoids, including the gigantic LINTHIA, from the Murray Basin. **Case 10.**

Sea-mats or Polyzoa (RETEPORA), and Lamp-shells or Brachiopods (MAGELLANIA); one cast in clear gypsum shows the brachial loop. **Case 11.**

Bivalved Mollusca, such as TRIGONIA, CHLAMYS, and SPONDYLUS. TRIGONIA, once living in the English area, is now only found round Australia. **Cases 11 to 13.**

Scaphopods (Elephant-tooth shells), Chitons or Mail-shells, and Gasteropods or Snails. **Case 13.**

These contain ancient Mutton-fish shells (HALIOTIS), Turret-shells (TURRITELLA), Cowries (CYPRAEA), Volutes (VOLUTA), Cones (CONUS), and NAUTILUS. **Cases 13 to 18.**

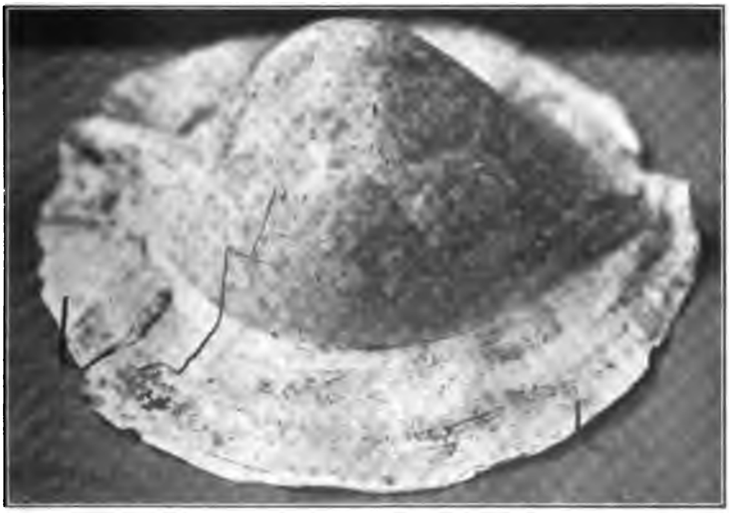

FIG. 16. A FLANGED COWRIE—*Palliocypraea gastroplax* (McCoy). From the Balcombian of Muddy Creek, near Hamilton.

Case 17. Here is a cast of a Nautilus shell in pure gypsum or selenite ($Ca\ SO_4+2H_2O$); through the transparent mineral infilling can be seen the median siphuncle preserved in natural position.

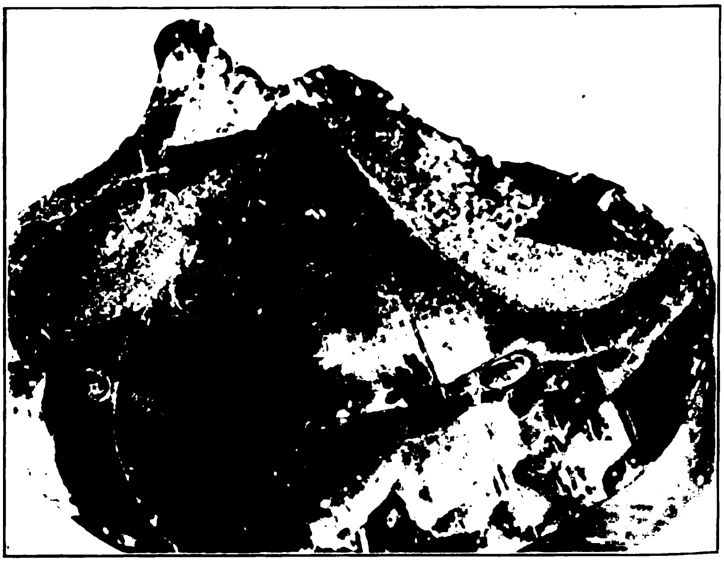

FIG. 17. FRAGMENT OF A FOSSIL *Nautilus*,—*N. altifrons*, showing interior of chamber filled with transparent gypsum, and with the Siphuncle in position.

Miocene. Murray Cliffs, South Australia.

Case 18. Here are shown extinct forms of Cuttle-bones. SPIRULIROSTRA is a very rare Miocene genus which is known to occur in only two other localities in the world. NOTOSEPIA is a fore-runner of the common *Sepia* and has a very strong and thick point or guard. In this case is also shown a fine series of Sharks' teeth, mostly of Miocene age, as well as a remarkably preserved fossil imprint of a Bird's feather in ironstone.

Teeth of the extinct Sperm-whales, **Parasqualodon** and **Metasqualodon** are also exhibited here, and also the tympanics ("ear-bones") of Whale-bone Whales (Fam. *Balaenidae*)

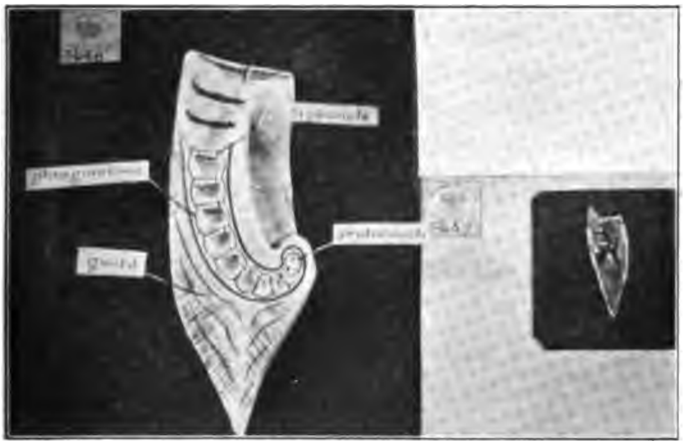

Fig. 18. Model and Shell of the Extinct Cuttle-fish—*Spirulirostra curta* Tate. Of Miocene age.

Bird Rock Cliffs, Torquay.

Case 19. Here is an interesting series of Cretaceous Mollusca, including **Inoceramus**, whose prism-like shell-fragments form thick beds of limestone in the marl series of Queensland. The impressions of a fern, **Microphyllopteris**, in sandstone is worth noting; also fossil Sponges (probably of the Lithistid type, **Siphonia**, which although originally siliceous or flinty, have been changed into iron pyrites (marcasite, a rhombic form of FeS_2)), but still showing the exact fig-like shape of the ancient sponge.

Case 20. This case contains some striking forms of Ammonites (BOLITECERAS) and a NAUTILUS. The internal bones of Cuttle-fishes (BELEMNITES) are also exhibited, which are very like those found in similar beds in Europe. A remarkable replacement in precious opal of the tooth of a Cretaceous Mudfish, METACERATODUS, is seen here, and also the scaly armour of the Ganoid fish, BELONOSTOMUS. The phalangeal or toe-bone of an extinct marine reptile, CIMOLIOSAURUS, makes a conspicuous object, as it, also, has been changed into precious opal.

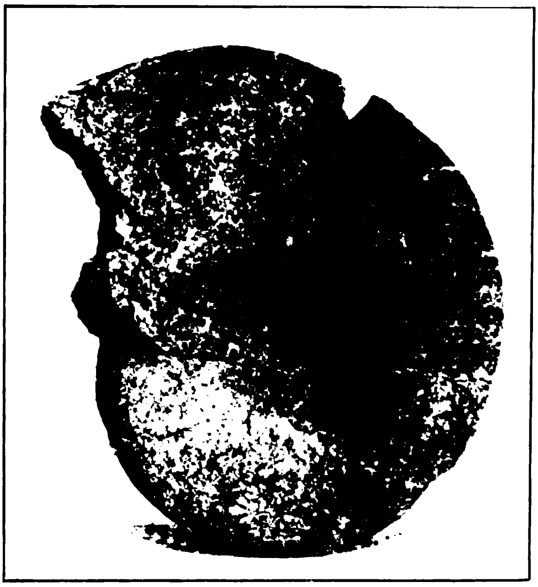

FIG. 19. AN AMMONITE—*Boliteceras daintreei* (Etheridge). Lower Cretaceous. Flinders River, Queensland.

Cases 21 and 22. These contain a unique series of Jurassic plants from Victoria, Queensland, and other parts of Australia. They comprise ferns, leaves of the Maiden-hair Tree (GINKGO), and Conifers, and represent the flora of the age of the Victorian bituminous coal.

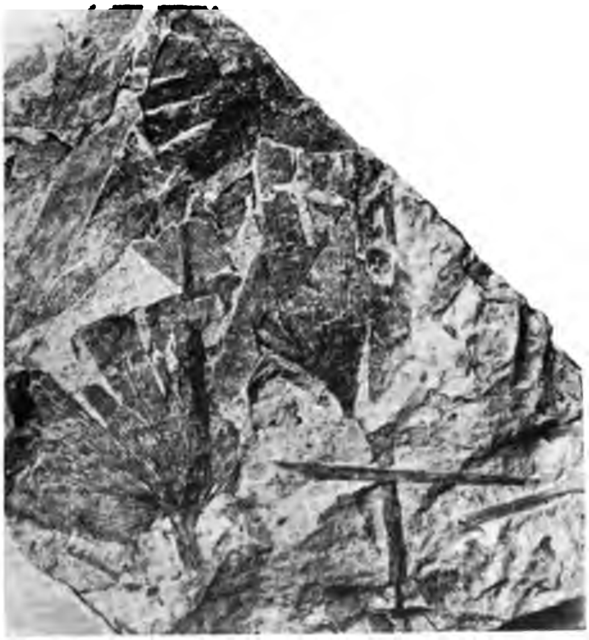

FIG. 20. *Ginkgo digitata* (Brongn). Triassic (Ipswich Series). Brisbane.

A good series of Jurassic shells of the tiny Foraminifera are shown, some as small as one-sixtieth of an inch in length; these were all picked out from the matrix of one fossil shell (TRIGONIA) from Geraldton, Western Australia. **Case 22.**

This case contains Jurassic Mollusca, Ostracoda (bivalved crustaceans) and a fine example of the small armoured fish, LEPTOLEPIS. Other unique fossils seen here **Case 23.**

are the claw of a carnivorous Deinosaur, and the scale and mandibular tooth of a Mudfish (METACERATODUS) from Cape Paterson, Gippsland.

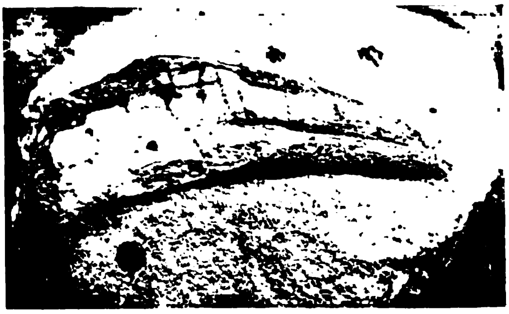

FIG. 21. CLAW BONE (Phalangeal) OF A CARNIVOROUS DEINOSAUR ALLIED TO *Megalosaurus*.
Jurassic. Cape Paterson, Victoria.

FIG. 22. A SCALE OF THE EXTINCT MUDFISH—*Metaceratodus ? avus* (A. S. Woodw.).
Jurassic. Kirrak, South Gippsland.

Cases 24 and 25.

Here is a series of plants and fishes from the Trias of New South Wales and Victoria. There are exhibited some remarkably well preserved fishes from the railway ballast quarry at Gosford, as CLEITHROLEPIS and the deep-bellied grovelling form PRISTISOMUS.

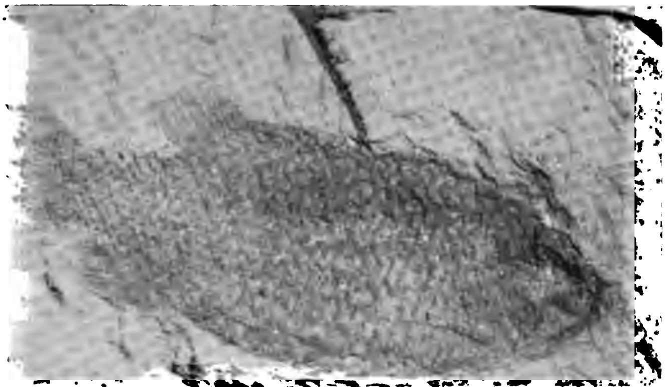

FIG. 23. *Pristisomus crassus* A. S. Woodward.

A GANOID FISH FROM THE TRIAS OF GOSFORD, NEW SOUTH WALES.

Cases 26 to 27.

These contain Permocarboniferous ferns, Foraminifera, Corals, and Molluscs. Amongst the noteworthy forms are GLOSSOPTERIS, a fern-like seed-bearing plant of the the Newcastle coal-beds ; Tasmanite shale, composed of spores (TASMANITES *punctatus*) ; ARAUCARIOXYLON, probably the oldest Araucarian tree ; the widely-distributed Sea-mats, as FENESTELLA ; and the great AVICULOPECTEN, EURYDESMA, and KEENEIA, of the phylum Mollusca.

Case 28.

Here is shown the type specimen of LEPIDODENDRON *australe*, supplemented with drawings of a restoration and specimens of leaves and bark. Here also is the

Carboniferous Sponge, RECEPTACULITES, and a selection of the fishes from Mansfield, such as GYRACANTHIDES (an early form of Shark), CTENODUS (a lung-fish), and STREPSODUS (a predatory fish with comparatively large tearing teeth).

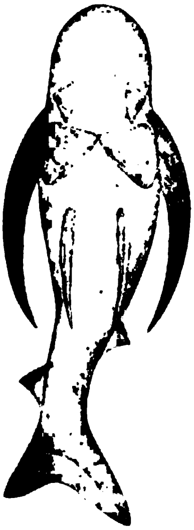

FIG. 24. GYRACANTHIDES.
Outline restored by A. Smith Woodward.

Cases 29 and 30. These comprise a series of Devonian fossils, including ferns, corals, mollusca, and the ancient air-breathing fish, PHLYCTAENASPIS ("*Asterolepis*" of McCoy).

Case 31. Silurian Corals are well represented, chiefly from Lilydale and Yass. Here we see the mound-shaped FAVOSITES, large forms of CYATHOPHYLLUM, and the interesting anchoring Coral, RHIZOPHYLLUM, which threw off root-like processes from the outer skeleton, enabling it to stand upright in the coral mud.

Cases 29 and 30.

Case 31.

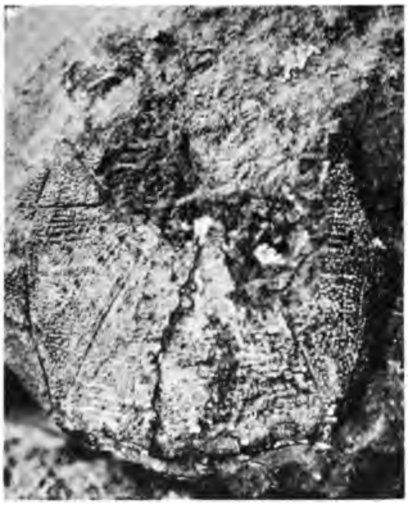

FIG. 25. MEDIAN DORSAL PLATES OF A "BERRYBONE" FISH—*Phlyctaenaspis australis* (McCoy), var. *confertituberculata* Chapm.
Devonian. Buchan, Gippsland.

Case 32. Here may be seen the unique impression of a jelly-fish (DISCOPHYLLUM *mirabile*) which was lately discovered in a Brunswick brick-pit. It is so well preserved that it shows the concentrically ribbed ornament, the manubrium, the genital pouches and even the hair-like tentacles.

In this case are also some Silurian Graptolites (MONOGRAPTUS, CYRTOGRAPTUS, and RETIOLITES); a remarkable series of Brittle-stars (PROTASTER, GREGORIURA, STURTZURA); Starfishes (URASTERELLA, PALAEASTER); and Crinoids (HAPALOCRINUS and HELICOCRINUS). The last-named is a remarkably fine example of a stalked starfish with a plumy crown, and a slender stem with coiled termination for attachment to seaweed or other marine objects. The stem-joints of Crinoids have in the past built up great masses of limestone at Toongabbie and the Thomson River in Gippsland.

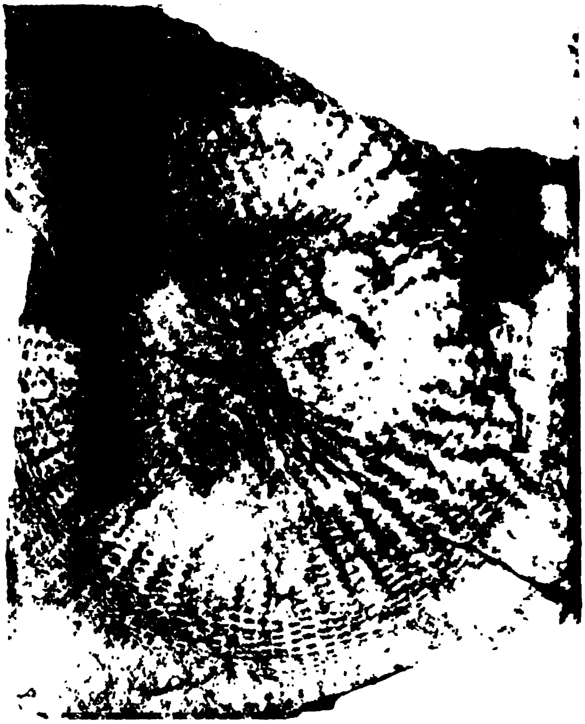

Fig. 26. A Silurian Jellyfish—*Discophyllum mirabile* Chapm. Brunswick, near Melbourne, Victoria.

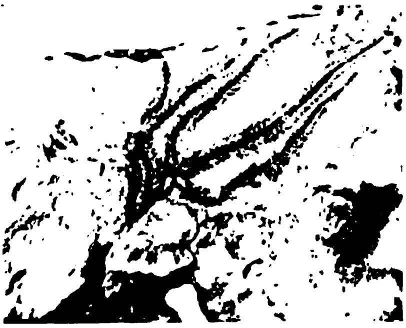

Fig. 27. *Gregoriura spryi* Chapm.
A Brittle-star, from the Silurian of South Yarra.

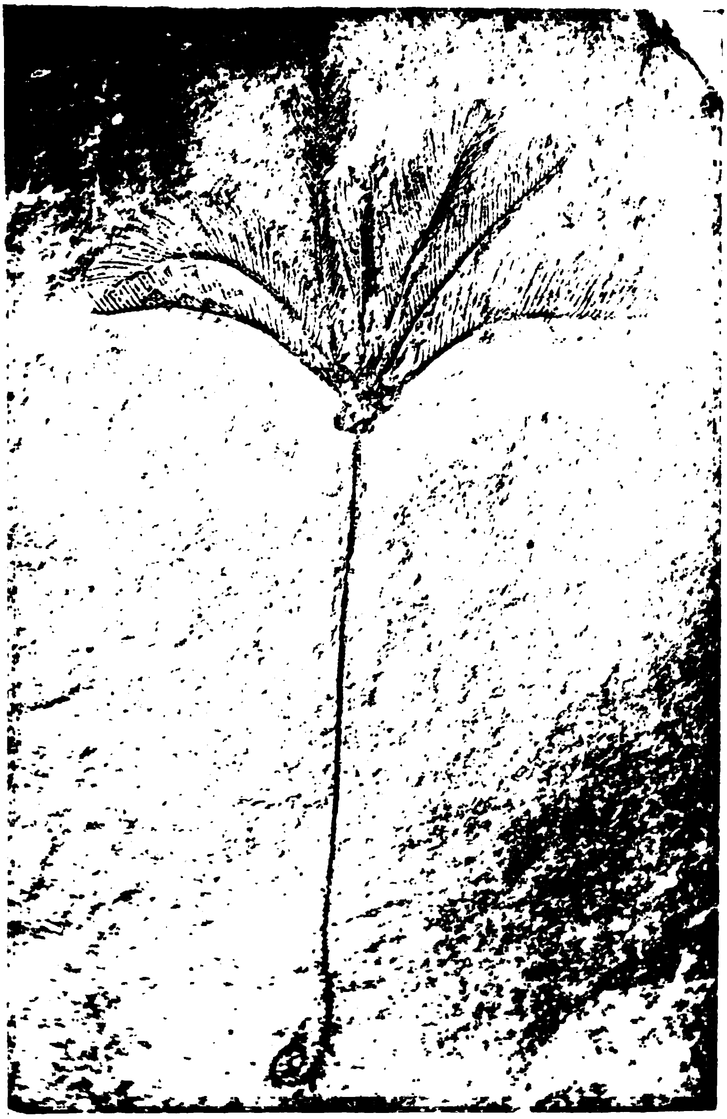

FIG. 28. *Helicocrinus plumosus* Chapm.
A CRINOID OR FEATHER-STAR, from the Silurian of Brunswick, Victoria.

Case 33. This contains Worm-tubes and the wonderful gill impressions of TRACHYDERMA, Sea-mats, as FENESTELLA and PINNATOPORA, and numerous Lamp-shells or Brachiopods; all of Silurian age. Amongst the Brachiopods we may note LINGULA *lewisii*, var. *flemingtonensis*, in which the *original phosphate of lime* in the shell *is still preserved* after the lapse of many millions of years; also CHONETES, remarkable for having hollow hinge-spines.

Case 34. Amongst the Brachiopods in this series may be noted ORTHIS, a common fossil in the Silurian mudstones round Melbourne; CAMAROTOECHIA, found in the sandstone under the Museum foundations; ATRYPA *fimbriata*, a handsome shell with a fringe of long spines around the edges; and SPIRIFER, named from the complex spiral brachidia or breathing apparatus.

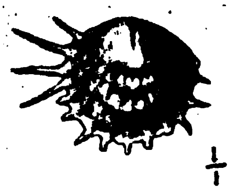

FIG. 29. A SPINOSE LAMP-SHELL—
Atrypa fimbriata Chapm.
From the Silurian of Lilydale, Victoria.

Case 35. Note the large ribbed, cockle-like shells of PANENKA, from the newest Silurian or lowest Devonian beds of Gippsland (Mount Matlock, &c.). These shells measure nearly four inches across. The genus PALAEONEILO is also a striking shell in its graceful contours and delicate surface markings. More than one species is identical with some from North America.

Case 36.

A Silurian Limpet of fine ornamentation is shown here, HELCIONOPSIS *elegantulum* ; it occurs in the limestone of Cave Hill, Lilydale. Another notable shell from the same locality is the trumpet-mouthed TREMATONOTUS, which has a series of openings along the back, reminding one of *Haliotis*, the ear-shell. BELLEROPHON is also a noteworthy genus a very form of which, *B. cresswelli*, has a large bell-mouth and prominent dorsal keel. PLEUROTOMARIA and the allied PHANEROTREMA belong to a group whose living descendants are very rare, PLEUROTOMARIA being known only by a few individuals at the present time.

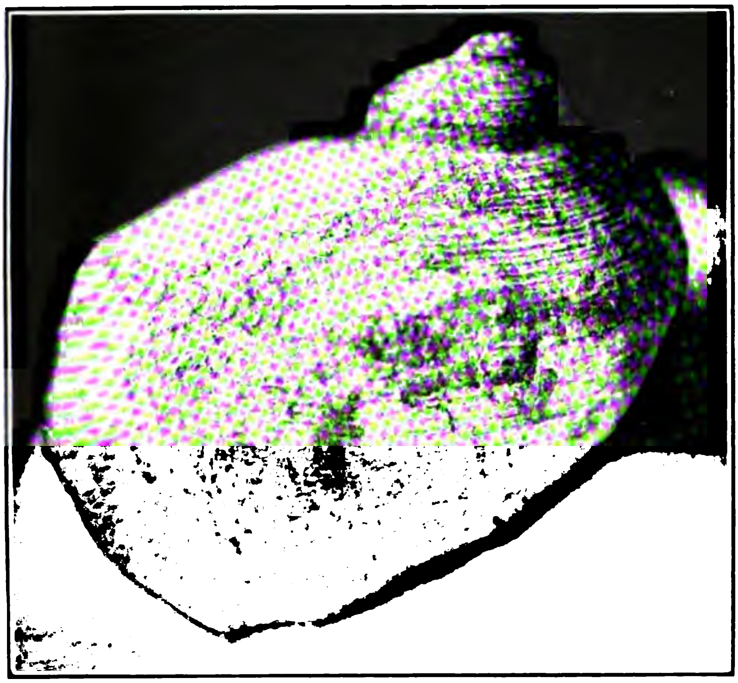

FIG. 30. A SILURIAN SLIT-BAND SNAIL—*Phanerotrema australis* Etheridge fil.

From the Cave Hill Quarry, Lilydale.

Case 37. The various forms of the *Murchisonia*-type (turreted shells with a slit-band) are well seen here, as COELOCAULUS, GYRODOMA, and CYRTOSTROPHA. Other forms are the large, flat, spiral gasteropods, EUOMPHALUS, like the living *Planorbis* in shape, though unrelated; and the top-shaped shell, SCALAETROCHUS. Pteropods are seen in STYLIOLA, a minute "sea-butterfly", also TENTACULITES, HYOLITHES (with a closing lid or operculum) and CONULARIA (having a fine surface ornament).

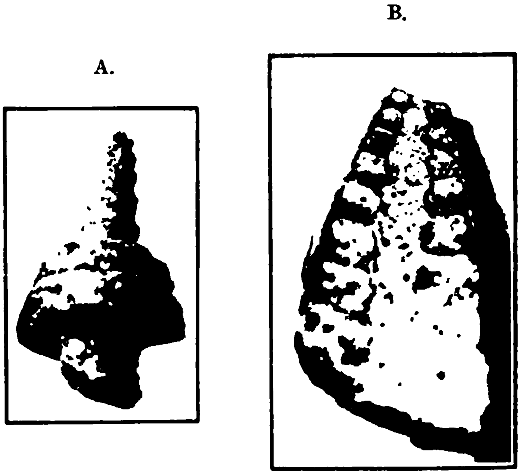

FIG. 31. A.B. A *Murchisonia*-LIKE SNAIL—*Coelocaulus brazieri* (Etheridge fil).

From the Silurian of Lilydale.

A. Broken whorls, with infilled Columella.
B. Section of Shell.

Case 38. The Cephalopods of the straight Nautilus type (orthoceracones) are well represented. Some shown here attain a length of eight inches. The Chinese call them "pagoda-stones," as they resemble in outline their tall, tapering temples.

Case 39. The Trilobites are amongst the commonest and most interesting of the Australian fossils. In the Silurian Table-case are TRINUCLEUS (with head-spine); GOLDIUS (formerly *Bronteus*) with fan-shaped tail segments; CALYMENE (capable of inrolling itself like a woodlouse); and DALMANITES (a large and handsome form with big compound eyes and a sharp tail-spine).

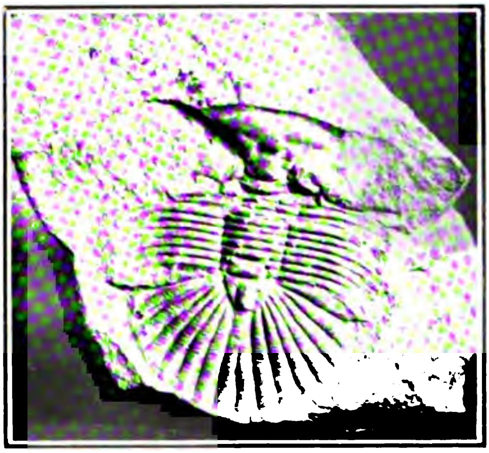

FIG. 32. A SILURIAN TRILOBITE—*Goldius greenii* Chapm.
From the mudstone of Lilydale, Victoria.

Case 40. This case is devoted to the Bivalved Crustacea known as Ostracoda; also the Pod-shrimps (CERATIOCARIS), and the Sea-scorpion (PTERYGOTUS). An interesting head-shield, referred to the primitive, jawless fish, THYESTES, is also to be seen here.

Case 41. Here the Graptolites of the Upper Ordovician slates are grouped. Amongst these may be noticed the sigmoidal hydrosome of NEMAGRAPTUS, the calliper- and lyre-shaped DICELLOGRAPTUS, and the tongue-shaped GLOSSOGRAPTUS. The primitive Brachiopod, SIPHONOTRETA, is also shown by a series of specimens from the grey shales of Bulla, Victoria. From the Macdonnell Ranges, South Australia, are some fine examples of Cephalopoda (ORTHOCERAS and ENDOCERAS).

Cases 42 to 44. The Lower Ordovician fossils in these cases are chiefly Graptolites, such as the net-like DICTYONEMA, the tuning-fork DIDYMOGRAPTUS, and the branching TETRAGRAPTUS, DICHOGRAPTUS, GONIOGRAPTUS, and CLONOGRAPTUS. Other interesting modifications are the biserial DIPLOGRAPTUS and GLOSSOGRAPTUS, and the leaf-like PHYLLOGRAPTUS. Molluscoids and Mollusca are rare (SIPHONOTRETA and HYOLITHES). The crustacea are represented by the well-distributed Pod-shrimps (RHINOPTEROCARIS), whose bodies were enclosed in a gauzy or chitinous covering, joined by a hinge-line along the back.

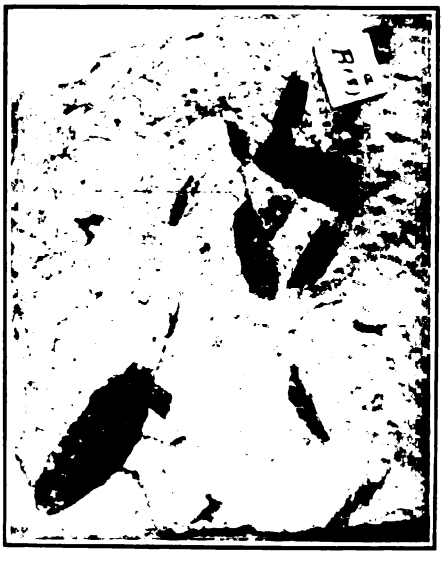

FIG. 33. *Rhinopterocaris maccoyi* Eth. fil.
Lower Ordovician. (Castlemaine series.)
Lerderderg River, Victoria.
G. S. V. Coll.

In this are arranged a good series of Cambrian fossils, comprising the lime-secreting sea-weed, GIRVANELLA; **Case 45.**

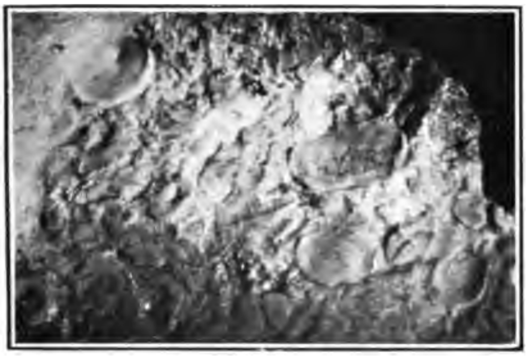

FIG. 34. *Girvanella* LIMESTONE.
Cambrian. Roan Horse Gully, North-East Gippsland.

also Coral and Sponge-like animals (ARCHAEOCYATHINA), primitive Lamp-shells and Mollusca (ORTHIS, PATELLA, EUOMPHALUS, PLATYCERAS, and SALTERELLA. Trilobites are seen in genera such as AGNOSTUS, CONOCORYPHE, OLENUS, PTYCHOPARIA, DIKELLOCEPHALUS, CREPICEPHALUS, and DINESUS.

FIG. 34A. *Girvanella* PELLET.
From the same limestone.

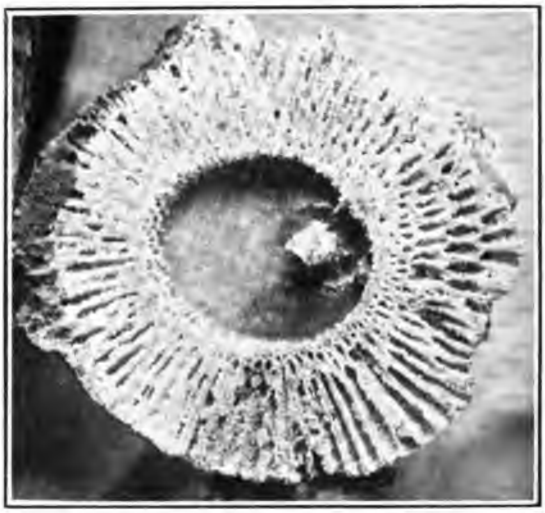

FIG. 35. ONE OF THE *Archaeocyathina* GROUP OR "SPONGE-CORALS," OF CAMBRIAN AGE—*Syringocnema favus* Taylor.

From the Ajax Mine, South Australia.

Photo. by Professor Griffith Taylor.

Exhibited on the wall next to the Geological map of Victoria is an outline map of Victoria, showing the principal localities where fossils have been found in the past.

One hundred and fifty-two localities where fossils have been obtained are marked on this map by a black spot. The chief *Groups of fossils* found in each locality and the *Age of the beds* are indicated by the lettering on the accompanying tables. Thus :—

> "Bairnsdale (8 BDFdG–KMPT)" signifies "of Barwonian age: Fossils.—Foraminifera, Corals, Sea-urchins, Worms, Polyzoa, Brachiopods, Pelecypods, Scaphopods, Gasteropods, Ostracods, Fishes."

The rivers are shown in *blue*, the railways in *red*.

FOSSILS OF NEW ZEALAND.

(EXHIBITED IN THE EAST GALLERY.)

The Newer Tertiary series (Wanganui System) is represented by a good collection of Molluscan shells, (including GLYCYMERIS, OSTREA, PECTEN, LUCINA, and STRUTHIOLARIA). **Cases 46, 47.**

The Older Tertiary fossils of the Oamaru System are well shown by a series of Echinoids (CIDARIS, LOVENIA, LINTHIA) and large specimens of MAGELLANIA, CUCULLAEA, CHLAMYS, and DENTALIUM. The type of VOLUTOSPINA *huttoni*, var. *rarispina*, McCoy, is also to be seen here. ATURIA *australis*, McCoy, a nautiloid shell also occurring in Victoria, shows the relationship of the Australian and New Zealand Tertiary faunas. **Cases 47, 48.**

The plant fossils of the Brown Coal Measures of the Lower Oamaru Series (Oligocene) are represented by leaves referred to the genera PODOCARPIUM (Coniferous) and PHYLLITES (Dicotyledonous). **Case 48.**

In the same case are exhibited a typical series of the Amuri System, recently acquired for the Museum from the New Zealand Geological Survey. Amongst these are the curiously twisted shells of CONCHOTHYRA *parasitica*, a unique type of shell related to the Strombids; and also a fine series of fish teeth, including those of the Goblin Shark (SCAPANORHYNCHUS).

The marine Jurassic (Putataka) Series of the Hokonui Ranges comprise genera such as INOCERAMUS, MACCOYELLA, MYTILUS, PHOLADOMYA, and BELEMNITES. **Case 49.**

The Jurassic Plant-beds of the Mataura (Estuarine) series contain many types common also to Australia. Amongst the notable kinds are the Horse-tail (EQUISETITES); Ferns, as CONIOPTERIS, DICTYOPHYLLUM and CLADOPHLEBIS; the primitive seed-bearing plant, TAENIOPTERIS; the Cycad, PTEROPHYLLUM; and the Conifers, PALISSYA and TAXITES.

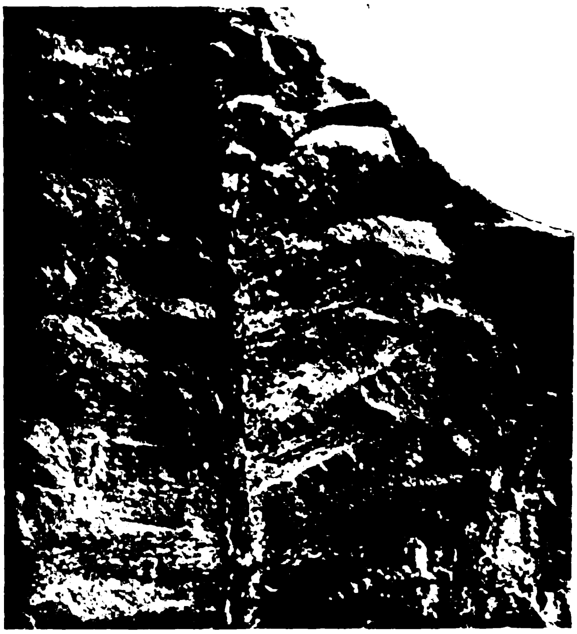

FIG. 36. A NEW ZEALAND FOSSIL FERN-PALM—*Pterophyllum matauriensis* Hector.
Jurassic. Mataura Falls, Otago.

Case 50. The Upper Triassic (Otapiri) fauna is represented by the handsome bivalved shell, PSEUDOMONOTIS *richmondiana*. Lower Triassic fossils of the Wairoa series are the interesting Mount Torlesse Annelid (worm tubes), the minute bivalved shell, HALOBIA *hochstetteri* and the comparatively large mussel, MYTILUS *problematicus*. Other Triassic shells exhibited here are the striking lamp-shell, HECTORIA *bisulcata*, the bivalved MYOPHORIA, and the slit-band snail, PLEUROTOMARIA.

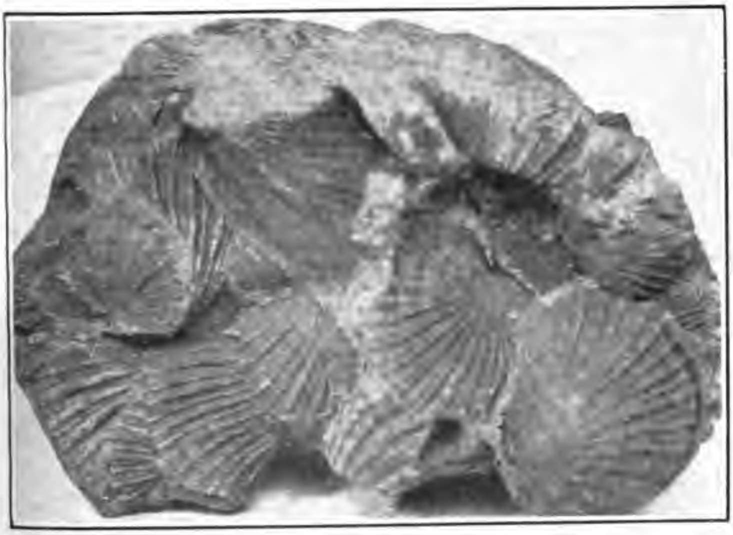

FIG. 37. A TRIASSIC BIVALVED SHELL FROM NEW ZEALAND—*Pseudomonotis richmondiana* (Zittel).

The Silurian fauna is contained in the Wangapeka series of Reefton, including the corals, FAVOSITES and PLEURODICTYUM; crinoids, lamp-shells as ORBICULOIDEA; a large form of ORTHOTHETES, CHONETES, ORTHIS, and SPIRIFER; the bivalved molluscs, GRAMMYSIA, PALAEONEILO and ACTINOPTERIA; the cephalopod, ORTHOCERAS; and the trilobite HOMALONOTUS.

FOREIGN FOSSILS.

THESE SPECIMENS ARE EXHIBITED IN THE SOUTH GALLERY.

Part of the floor-space is occupied by large cases and restorations.

COLOSSOCHELYS *atlas*.—This is a restoration of fragments of the carapace and plastron of a giant Tortoise from the Lower Pliocene beds of the Siwalik Hills, India. It probably measured about eight feet in length. The living Giant Tortoise of the Galapagos Islands off the coast of South America, and the Mascarenes near Madagascar, measures about four feet long.

The Edentates or group of the Sloths are here represented by magnificent casts of the Giant Sloth (MEGATHERIUM) and the curious carapaced GLYPTODON with armoured tail; both are from the Pleistocene or Pampas Formation of South America. A group of outline sketches of the contemporaneous animals of this Pampas Formation is framed, above the Mammal case.

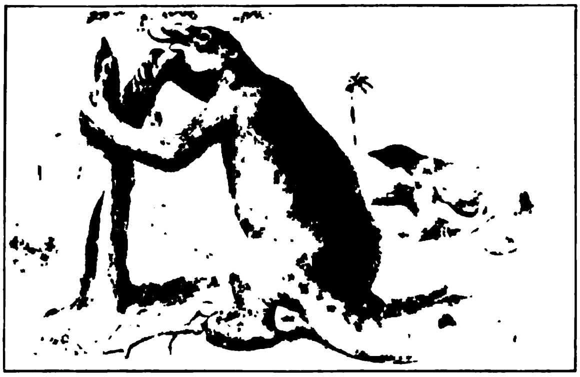

FIG. 38. RESTORATION OF THE GIANT SLOTH—*Megatherium americanum.*

The extinct Elephants are represented by casts of the cranium of the Lower Pliocene DEINOTHERIUM, which has a pair of tusks only in the lower jaw, and the Mastodon

(MASTODON *americanus*). Other casts are:—Crania of the extinct Pliocene Indian Elephants of the Stegodont ("plated-tooth") type, and the Loxodont ("lozenge-tooth") types.

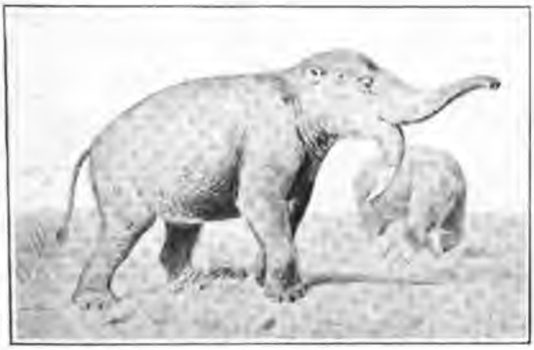

FIG. 39. RESTORATION OF THE PLIOCENE ELEPHANT—*Deinotherium giganteum*.

The fore-leg and cranium (casts) of SIVATHERIUM, a gigantic Giraffe of the Siwalik Formation of India, form notable objects. An accompanying drawing of a restoration shows the characteristic bilobed canine peculiar to the Giraffidae. (See also the modern OKAPI in the Lower hall.)

Two extinct Birds, the Dodo (DIDUS *ineptus*), from Mauritius, and the New Zealand Pigeon Goose (CNEMIORNIS *calcitrans*), are represented by partial skeletons.

On the wall are hung some fine slabs of sandstone showing Fossil Footprints. These were impressed, many aeons ago, on the soft Triassic sands, by the giant Amphibian named CHEIROTHERIUM (literally "hand-beast" on account of the shape of the prints). Casts of other footprints, from Connecticut, show the impressions which were made by small bird-footed reptiles.

Marine Crocodiles (STENEOSAURUS) are shown both by casts and an original skeleton embedded in marlstone. These early forms were armoured both above and below. A cast of the Jurassic Crocodile, PELAGOSAURUS *typus*, in a Table-case near the Elephants, shows the slender body and delicate scutes of this Liassic form, which in the original consists of 75 parts, and worked out of the matrix of the rock by Professor Deslongchamps.

The armoured Stegosaurian Reptile, HYLAEOSAURUS *armatus*, is shown by a cast of Mantell's original specimen from the Weald of Sussex.

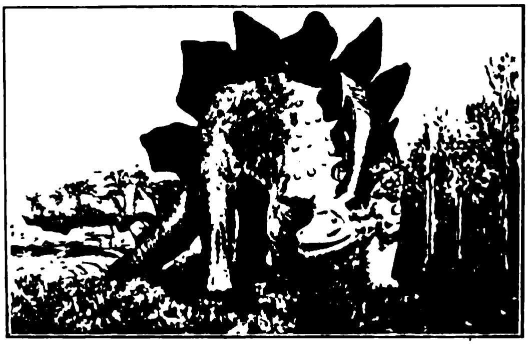

FIG. 40. RESTORATION OF A STEGOSAURIAN REPTILE—
Stegosaurus ungulatus.
Upper Jurassic. Colorado.

A fine collection of Fish-lizards, or ICHTHYOSAURUS, is hung on the wall of this Gallery, comprising five species (I. *acutirostris*, I. *communis*, I. *intermedius*, I. *platyodon*, and I. *tenuirostris*). Some of these are original examples, and most of them show the kinked caudal region of the vertebra which indicates the fish-like heterocercal tail, predicted by Owen and confirmed by later discoveries. Compare the Queensland specimen from the later formation of the Cretaceous (in Case on east wall of Gallery), representing the last dying members of the race which, besides living in European seas, sought refuge in southern waters, as in Chile, New Zealand, and Australia.

THAUMATOSAURUS, a short-necked Marine Reptile, is represented by a fine replica of the fossil which is in the Museum of the Royal Dublin Society. It measures about 27 feet in length. These Sauropterygians ("Lizard-finned" Reptiles) were contemporaneous with the Fish-lizards, and had similar paddles, but unlike them, the five reptilian toes were not supplemented by extra bones. (See Fig. 9.)

A cast of PLESIOSAURUS *hawkinsi* here exhibited is another but more slender form of the same order.

Of the flesh-eating reptiles, a notable example among the Deinosaurs is TYRANNOSAURUS *rex*, a huge carnivorous reptile found in the Cretaceous beds of Montana. U.S.A. A fine cast of the skull is here exhibited, of which the original is in the American Museum of Natural History. The complete skeleton of this beast measures over 44 feet in length.

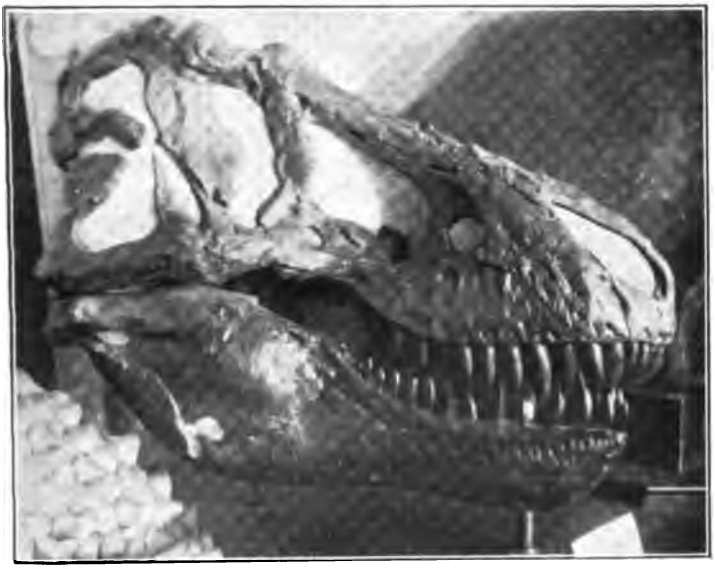

FIG. 41. A CARNIVOROUS DEINOSAUR, CAST OF HEAD OF—
Tyrannosaurus rex. Cretaceous.
Montana, U.S.A.
Exch. U.S. Nat. Mus.

Some of the herbivorous reptiles of the Jurassic seas were egg-laying (oviparous) and a fine series of their fossilized eggs were obtained by an expedition from the American Museum of Natural History in Mongolia. A cast of one of these eggs is shown in this Gallery. On the other hand, the Ichthyosaurians or Fish-lizards are known to be viviparous.

Other casts on the wall of the South Gallery are:—an Upper Jurassic Turtle (PLEUROSTERNUM); a great Ganoid Fish (LEPIDOTUS *maximus*); a "Fringe-finned" Ganoid of the

Old Red Sandstone (HOLOPTYCHIUS); a Jurassic fore-runner of the Angel-fish (SQUATINA *alifera*); Sea-scorpions (SLIMONIA and STYLONURUS); and Sea-lilies (PENTACRINUS), of which there are also two fine original specimens from Dorset and Wurtemberg.

A Case of MODELS OF FORAMINIFERA, prepared by Reuss and Fritsch, shows the wonderful variation in this group of microscopic fossils, and actual specimens are mounted alongside indicating their minute size.

Ranged just above the floor angle is a series of large Cephalopod shells, comprising Ammonites such as PACHYDISCUS from the Lower Chalk, PARKINSONIA from the Inferior Oolite, AEGOCERAS from the Lower Lias, as well as a NAUTILUS from the Oxford Clay. This series is supplemented by a Floor-case with STEPHANOCERAS, CYRTOCERAS, AGONIATITES, ARIETITES, SONNINIA, ASPIDOCERAS, and AMALTHEUS, also large specimens of LIMA, PINNA, CAPRINA, PLEUROTOMARIA, and NATICA, in illustration of the Phylum Mollusca.

Two long Wall-cases are devoted to exhibits of Fossils generally too large to show in the Table-cases.

MAMMALS.

Here are seen the Giant Lemur, MEGALADAPIS (cast of skull); the Sabre-toothed Cat, MACHAERODUS (cast of skull); a fine original skull of the Cave-Bear, URSUS *spelaeus*, from

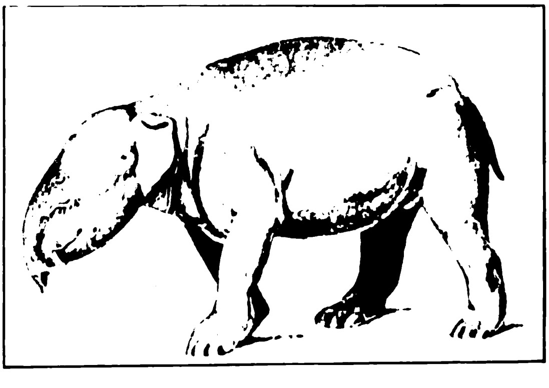

FIG. 42. RESTORATION OF THE EOCENE ELEPHANT—*Moeritherium lyonsi*. Egypt.
See model of skull in Wall-case.

Bohemia; a series of casts illustrating the ancestry of the Horse; various types of primitive Pigs, Camels, and Cattle; the early forms of Elephants as MOERITHERIUM and PALAEOMASTODON (casts); teeth and casts of jaws of the Mammoth and Mastodon; and the ancestral Toothed Whales, PROZEUGLODON and ZEUGLODON.

BIRDS.

Three fine replicas of ARCHAEOPTERYX, from the Berlin and London Museums, are shown here. The originals are from the Upper Jurassic lithographic stone of Bavaria. This ancient bird shows connecting links with certain reptiles like COMPSOGNATHUS. Their bones were not pneumatic (cellular) as in modern birds, the vertebrae were flattened or concave and the tail was lizard-like, whilst the margins of both jaws carried a row of socketed teeth.

In a small case, near by, is a perfect specimen of the egg of the great extinct Ostrich, STRUTHIOLITHOS, which lived in late Pleistocene times in Russia, India, and Northern China. It was found in red loess associated with chipped tools of ancient man of the Azilian period, dating back about 25,000 years.

REPTILES.

MOSASAURUS is represented by a vertebral bone. Various types of Crocodiles are illustrated by GONIOPHOLIS, ATOPOSAURUS, STENEOSAURUS, and THORACOSAURUS.

The Deinosaurian remains comprise gigantic footprints and a cast of the foot of IGUANODON.

The flying Dragons (Pterosauria) are illustrated by a restoration (drawing) of PTERANODON, which probably measured 29 feet from tip to tip of the wings. Some of these flying reptiles were as small as a sparrow, as PTERODACTYLUS *meyeri*, of which casts of this and other related fossil remains are shown.

Examples of the curious primitive reptiles, the Theromorphs (" beast-forms ") exhibit strong laniary and crushing teeth.

AMPHIBIA.

These are represented by a cast of ANDRIAS *scheuchzeri* (referred to by the old geologists as " homo diluvii testiis ", —Man the witness of the Flood), which sensational discovery of two centuries ago turned out to be simply the remains of a Salamander. The Labyrinthodont, **Trematosaurus**, of which there are some good originals from the Bunter Sandstone of Germany, and **Archegosaurus**, a still older (Lower Permian) Amphibian.

Coloured drawings of restorations of extinct animals are mounted above these cases.

Fishes.

From a very complete series of these remains the following may be selected as of especial interest. The jawless fishes (Agnatha), as **Bothriolepis**, show the primitive armoured body having anterior jointed swimming appendages. **Palaeospondylus** is a small forerunner of the modern Lamprey. These fossils measure a little more than an inch in length and are found in the bituminous sandstone of Caithness.

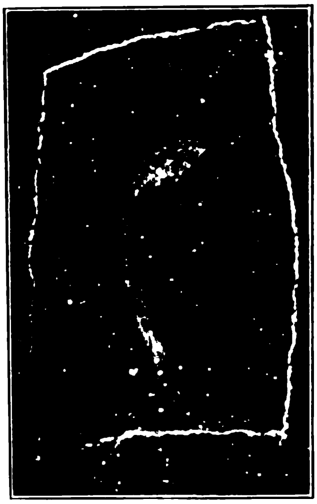

Fig. 43. A Primitive Lamprey-like Fish—
Palaeospondylus gunni Traquair.
From the Old Red Sandstone of Caithness, Scotland.

The Dipnoi ("double-breathers"), to which the modern lung-fishes belong, were much in evidence as far back as Devonian times (**Phaneropleuron**). **Phlyctaenaspis** is a Coccostean ("berry-bone fish") which occurs in the Buchan limestone, and here well shown by Scottish specimens.

In the Crossopterygii ("fringe-finned" Ganoids) the teeth are of remarkable structure, having a tree-like grouping of the dentine tubules, seen in cross section, hence the name "*Dendrodus*" for the teeth of HOLOPTYCHIUS.

The Ganoids, or enamelled scale fishes, were either of the grovelling type (short and deep bodied), or predatory (with thinner and lithe bodies). The former are represented by LEPIDOTUS and the latter by CATURUS. Many of the short forms had bean-shaped teeth, which were shed successionally. Early types of Bony Fishes (Teleostei) are seen in LEPTOLEPIS and OSMEROIDES. Herrings (CLUPEA) made their appearance in the Cretaceous, and most of the living genera followed in early Tertiary times, as Pike, Perch, and Mackerel, of which there are examples shown here.

The first Sharks were small and spiny, and began to appear in the Lower Devonian (MESACANTHUS and DIPLACANTHUS). The modern genera, as LAMNA, did not exist, however, before Cretaceous times, whilst CARCHARODON is typically early Tertiary to Recent, though some teeth have lately occurred in New Zealand rocks which have been referred to the Danian (Upper Cretaceous).

ARTHROPODA.

A good series of the animals with "jointed feet" is shown here, including Flies (Diptera), Ants (Hymenoptera), Beetles

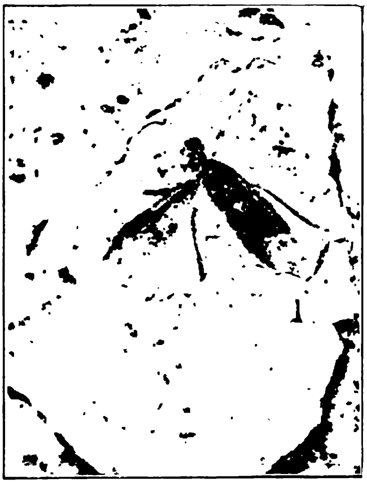

FIG. 44. A DIPTEROUS INSECT—*Protomyia bucklandi* Heer.
From the Oligocene of Aix, Provence, Southern France.

(Coleoptera), Dragon-flies (Odonata), Locusts (Orthoptera), Prawns, Lobsters, and Crabs (Decapoda), King Crabs and Sea-Scorpions (Merostomata), Barnacles (Cirripedia), and Trilobites. An Ant, FORMICA *lignitum*, is here exhibited, beautifully preserved in Eocene clay; whilst a Fly, MUSCA *lithophila*, and a Beetle, CHRYSOBOTHRUS *veterana*, are seen embedded in Upper Jurassic marlstone.

MOLLUSCA.

Amongst the shell-fish we may notice the Cephalopoda or Cuttle-fishes, as NAUTILUS, ORTHOCERAS, and Ammonites. The delicate COSMOCERAS, a pearly Ammonite from Wiltshire, should be noted; also the showy median slices of other Ammonites, as PARKINSONIA and AEGOCERAS.

Of the Gasteropods, CERITHIUM *giganteum*, from the Tertiary of the Paris Basin, is a conspicuous object, the shell measuring fifteen inches in length.

Other specimens shown here include various Corals ("madreporites"), Sponges ("Ventriculites"), and Worms.

PLANT FOSSILS.

A selected series of plant-remains is placed in the end of this Wall-case. The specimens range from fossil Sea-weed, through Mosses, Horse-tails, Club-mosses, Ferns, Fern-palms, Conifers, and Flowering Plants.

The TABLE-CASES OF FOREIGN FOSSILS (numbered from 101 to 120) contain fossils from extra-Australasian localities, as Europe, North America, India, &c., and range in age from PLIOCENE to CAMBRIAN.

Table, Case 101. The faunas of the White and Red Crag of Suffolk are well represented. Amongst these fossils may be noted an encrusting Hydroid, HYDRACTINIA; the large boulder-like limy skeleton or zoarium of a Polyzoan, THENOA; a reversed Whelk, CHRYSODOMUS; and a tympanic bone of a Whale, BALAENODON.

Cases 102 and 103. Comprise Miocene fossils, many of which are of the same generic type as those found round Geelong and Bairnsdale. Here are the curious Sea-urchin, CLYPEASTER *umbrella*; SPONDYLUS *gaederopus* (very like the Victorian species, *S. gaederopoides*); and a fine series of Sharks' teeth and compressed remains of the Toothed Carp, PROLEBIAS.

Case 104. Contains some interesting Oligocene Corals (TURBINOLIA and CARYOPHYLLIA), the freshwater Snail (PLANORBIS) of the Oligocene of the Isle of Wight; also Sharks' teeth (NOTIDANUS, ODONTASPIS, and CARCHARODON). The eggs of Turtles are rare fossils, and some exhibited here were found associated with a freshwater fauna.

Cases 105, 106. Here are some delicate fossil leaves from the Eocene of of Alum Bay in the Isle of Wight; also discoidal Foraminifera known as NUMMULITES from Italy and India; the giant Sea-urchin, CLYPEASTER; a fine series of volute Gasteropods; the extinct Cuttle-fish bone, BELOSEPIA; and a series of Sharks' teeth.

Case 107. Cretaceous fossils are represented by a Fern stem TEMPSKYA, found in the Weald of Buckinghamshire; Siliceous Sponges as SIPHONIA and PLOCOSCYPHIA; "Shepherd's Crowns" (CYPHOSOMA); Cephalopods, as BACULITES (showing foliated sutures); and various Ammonites. Here are some good specimens of the teeth of a kind of Ray, PTYCHODUS, termed "Fossil slugs" by quarrymen.

Case 108. This Case is occupied by Jurassic Plants, chiefly from the Wm. Bean collection, of Yorkshire. They comprise Liverworts (MARCHANTITES); Horse-tails (EQUISETITES); Ferns (TODITES, CLADOPHLEBIS, and SPHENOPTERIS); the Fern-like (TAENIOPTERIS); Fern-palms (WILLIAMSONIA); and Maiden-hair Trees (GINKGO).

Case 109. Amongst Oolitic fossils here shown is a remarkable Starfish (ASTROPECTEN). Other specimens of interest are "pear Encrinites" (APIOCRINUS), in which the crown of this Sea-lily is shaped like the fruit; a curious Bivalve with bar-like hinge-teeth, PARALLELODON; some ancestral Trigonias, differing from the living Australian species in having concentric ribs; and an interesting series of Ammonites, Belemnites, Prawns, and a Dragon-fly.

Case 110. Liassic fossils include fossil Ferns, as LACCOPTERIS, DICTYOPHYLLUM, and SAGENOPTERIS; whilst the Maiden-hair Tree has an early relative in BAIERA. The beautiful little Brittle-star, OPHIODERMA, is seen lying on the original hardened sea-mud as found in the cliffs at Bridport, England. The "devil's toe-nail" (GRYPHAEA), the slit-band Snail (PLEUROTOMARIA), and an Ammonite with the mouth-closing operculum (aptychus) in position, form other interesting exhibits.

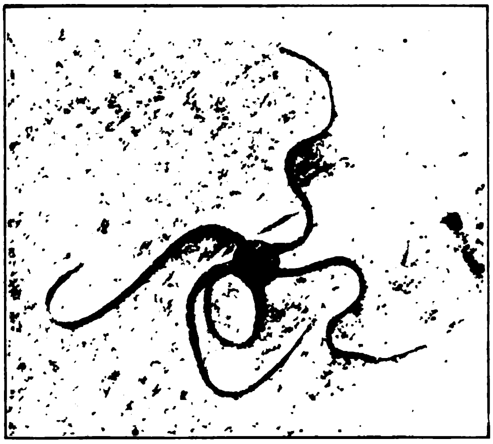

FIG. 45. A BRITTLE-STAR FROM THE LIAS OF DORSET—*Ophioderma egertoni* (Broderip).

Case 111. Amongst the plants of the Trias are the ancestors of the living Horse-tails (EQUISETUM), and some ancient types of Fern-palms (OTOZAMITES and PTEROPHYLLUM). The handsome Stone-lily (ENCRINUS) from Brunswick, Germany, and a NAUTILUS (*N. sauperi*) from Austria showing pearly lustre after many aeons, are worth noting.

Case 112. Club-mosses, Fern stems and Coniferous wood, some of which are shown in polished slices, form an interesting exhibit in this Permian series; and from the same formation are marine representatives: Corals, Lamp-shells, Molluscs, and Fishes, the latter group including a spine-bearing Shark, ACANTHODES, only five inches long. In the same case are several beautifully preserved stems and branches of Carboniferous trees belonging to the Horse-tail

(CALAMITES, CALAMOCLADUS) and the Club-moss (LEPIDODENDRON) groups.

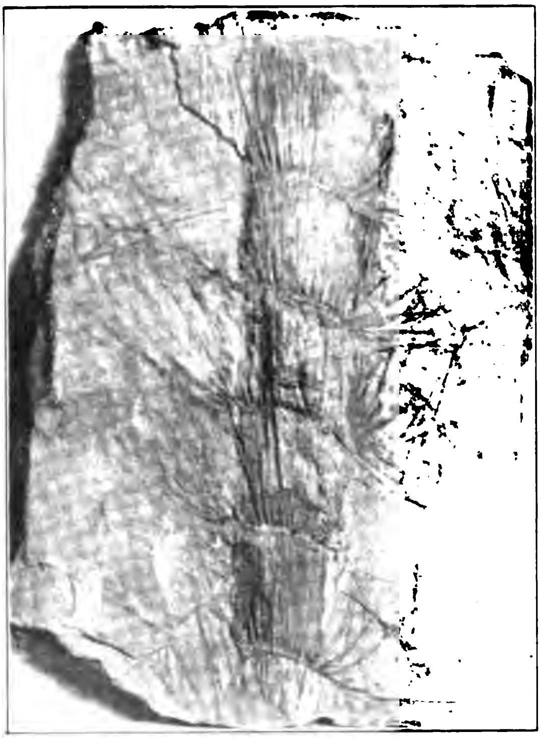

FIG. 46. A CARBONIFEROUS HORSE-TAIL.—*Calamocladus equisetiformis* (Schloth).

From Silesia.

Here are Carboniferous examples of the true Ferns (SPHENOPTERIS, PECOPTERIS, as well as fern-like seed-bearing Plants (ALETHOPTERIS, NEUROPTERIS)). The marine fossils of this period include Foraminifera (FUSULINA and SCHWAGERINA); Corals (CYATHAXONIA, LITHOSTROTION); Sea-lilies (ACTINOCRINUS); Lamp-shells (LINGULA, SPIRIFER); and Molluscs (AVICULOPECTEN, CARBONICOLA, BELLEROPHON, and GLYPHIOCERAS). **Case 113.**

Case 114. Devonian Corals are well represented by ZAPHRENTIS, CYATHOPHYLLUM, and PHILLIPSASTRAEA, amongst others. Stromatoporoids are seen in the massive ACTINOSTROMA, Sea-lilies in MELOCRINUS with coiled stem, and Starfishes in ASPIDOSOMA and ROEMERASTER, the latter a very fine species from the Upper Devonian slate of the Harz district. Other fossils include SPIRIFER *laevicosta*, interesting in being so nearly related to the Australian *S. yassensis*.

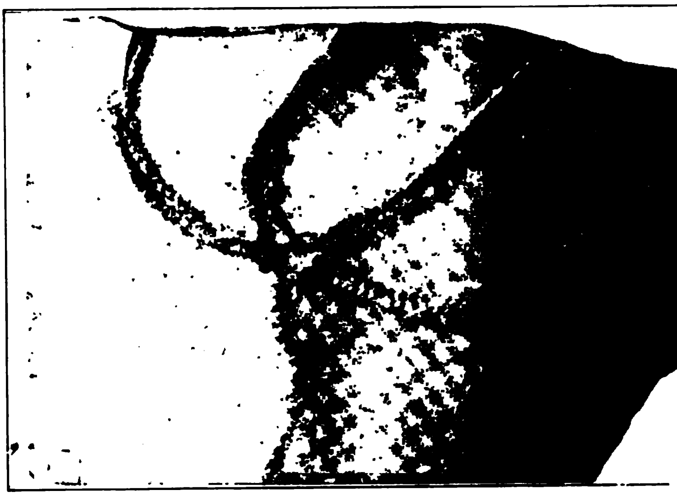

FIG. 47. A DEVONIAN BRITTLE-STAR—*Roemeraster asperula* (Roemer
From Bundenbach, Germany.

Case 115. Devonian Molluscs are represented by numerous genera, the Cephalopods being of particular interest and diversity (PHRAGMOCERAS, OXYCLYMENIA, and GEPHYROCERAS). Devonian Trilobites are shown HOMALONOTUS, CHEIRURUS), as also Ostracoda (ENTOMIS). Numerous examples of Devonian Fishes are represented by PALAEOSPONDYLUS, an ancient Hag-fish, as well as the armoured fish with appendages, PTERICHTHYS. Representatives of the oldest Sharks are seen amongst these fossils, as MESACANTHUS, and there are spines of fishes of the same group, as CLIMATIUS.

Here is the interesting Silurian bag-shaped Sponge, ISCHADITES. Silurian Corals are well represented, as CYATHOPHYLLUM, CYSTIPHYLLUM, LINDSTROEMIA, OMPHYMA, ACERVULARIA, FAVOSITES, HALYSITES, and others. The Stomatoporoids exhibit various modes of growth: LABECHIA, encrusting; STROMATOPORA, boulder-like; CLATHRODICTYON, tumulose. A fine collection of Graptolites, as MONOGRAPTUS, RASTRITES, and DIPLOGRAPTUS is placed here, chiefly from Bohemia; whilst Stone-lilies are seen in the Wenlock forms, PERIECHOCRINUS, EUCALYPTOCRINUS, TAXOCRINUS, and others. **Case 116.**

The bud-shaped Cystoids, of Silurian age (CARYOCRINUS, PSEUDOCRINITES) are shown. Brittle-stars are seen in PROTASTER, STURTZURA, and LAPWORTHURA; whilst among Starfishes we may note PALAEOCOMA with its long brush-like series of ossicles, BDELLACOMA and RHOPALOCOMA; also Polychaete Worms (CORNULITES) and Lamp-shells, as STROPHONELLA, CHONETES, ORTHIS, CAMAROTOECHIA, SPIRIFER, and many others. **Case 117.**

Continuing the Silurian series, Bivalved Molluscs are seen in the cockle-like PANENKA, the winged PTERINAEA, and PROLUCINA. Of the Silurian Snails we may note MURCHISONIA, EUOMPHALUS, OMPHALOTROCHUS, and the air-breathing HERCYNELLA, also found in the Silurian rocks of Victoria. Cephalopods of this age are very striking in appearance and include ORTHOCERAS, GEISONOCERAS, DAWSONOCERAS, KIONOCERAS, and OOCERAS. Trilobites are in great variety (HARPES, ILLAENUS, GOLDIUS, PROETUS, ACIDASPIS, ENCRINURUS, CALYMENE, and CHEIRURUS). Exceptionally large species of Ostracoda are seen here, in LEPERDITIA from the Baltic clays, and there is also a fine head of a water-scorpion, EURYPTERUS. **Case 118.**

The oldest species of the RECEPTACULITES group of Sponges is shown here, in which the placing of spicules in quincuncial manner and the handsome platter-like form is very striking. Other Ordovician fossils are Corals (STREPTELASMA and FAVOSITES); Graptolites (DIDYMOGRAPTUS and PHYLLOGRAPTUS); **Case 119.**

Lamp-shells (ORTHIS and RHYNCHOTREMA); Bivalved Molluscs (NUCULA and AMBONYCHIA); Marine Snails (PLEUROTOMARIA and HOLOPAEA); Cephalopods (ENDOCERAS and CYCLOCERAS); and Trilobites (including the handsome HARPES, TRIARTHRUS in which air-breathing appendages were first found), and DALMANITES with its conspicuously facetted eyes.

Case 120. Contains some of the oldest fossils known, of Cambrian age. Amongst the more interesting of these are the supposed fossil Seaweed, OLDHAMIA, and the gigantic, spined Trilobite, PARADOXIDES. HYMENOCARIS *vermicauda* is a pod-shrimp allied to the living NEBALIA, and which is also represented generically in Victorian rocks.

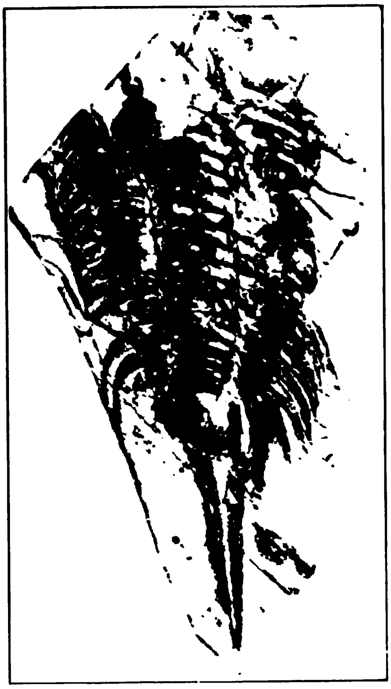

FIG. 48. A MIDDLE CAMBRIAN TRILOBITE—
Paradoxides davidis Salter.
From South Wales.
About one-third natural size.

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